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TWENTY-FOURTH YEAR

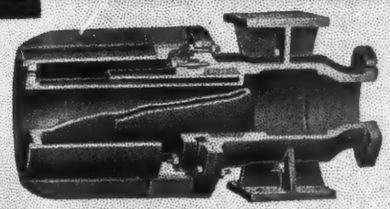
# The Heating and Ventilating Magazine

*A Monthly Journal of Engineering Progress*

XXIV. No. 6
0 a year. 30 cents a copy.

JUNE, 1927

Published monthly by
Heating & Ventilating Magazine Co.
1123 Broadway, New York

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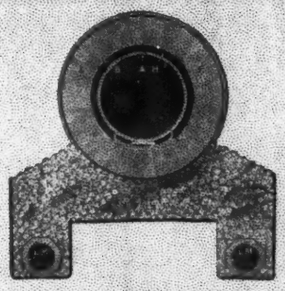

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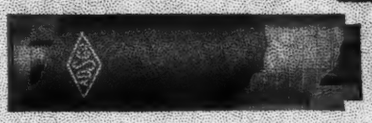

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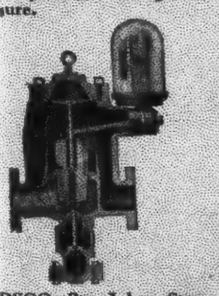

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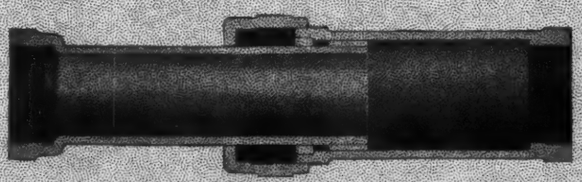

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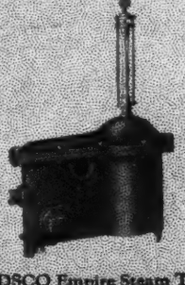

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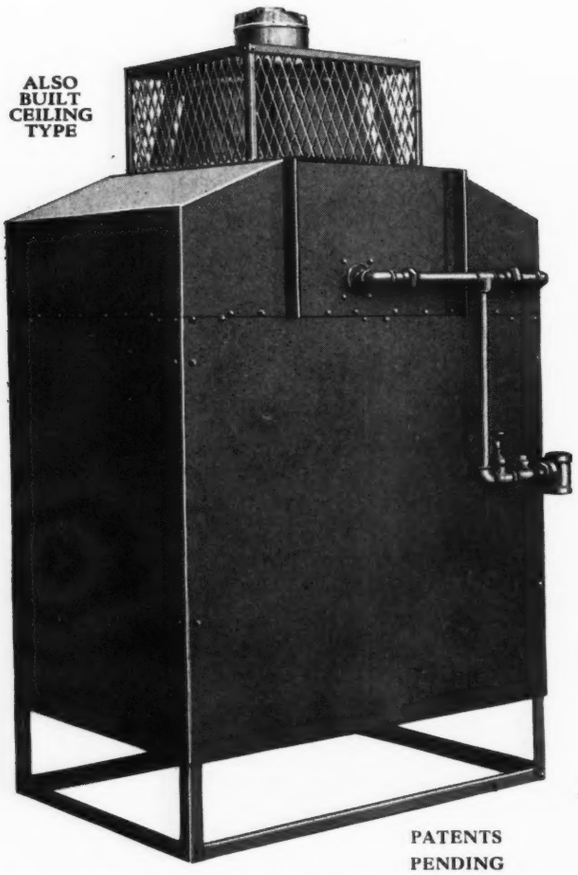


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**YEARLY SUBSCRIPTION $2.00** **SINGLE COPIES, 30 CENTS**

**Published monthly at 1123 Broadway, New York, by the Heating and Ventilating Magazine Co.**

**Entered as second-class matter, April 18, 1925, at the Post-Office at New York, N. Y., under the Act of March 3, 1879.**

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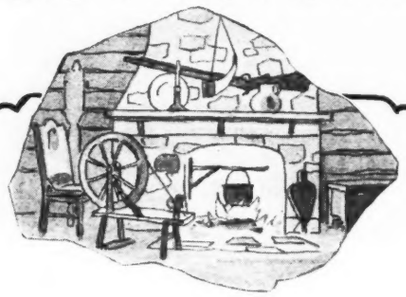
# The Progress of Heating and the Prevention of Heat Waste

*Fourth of a Series*



## The Fireplace

### A 17th Century Advancement . .

The heating apparatus of our forefathers was the open fireplace: which followed the advent of the chimney. Particularly does history relate of the old New England fireplace, six to eight feet in length and of generous depth to sit far within for warmth. Here, though — as related — a very large proportion of the heat thus obtained escaped up the chimney: from eighty-five to ninety per cent. Every effort was made toward improving heating methods; with no way, however, of thwarting heat waste. Heating methods and apparatus indeed have advanced and improved for our day. Yet, the fact exists that there still remains a heat and fuel waste and loss of as much as 40 per cent in present day buildings. For, The Johnson System of Heat Control shows records and figures of reducing fuel consumption that vast proportion annually, in buildings that are Johnson equipped.

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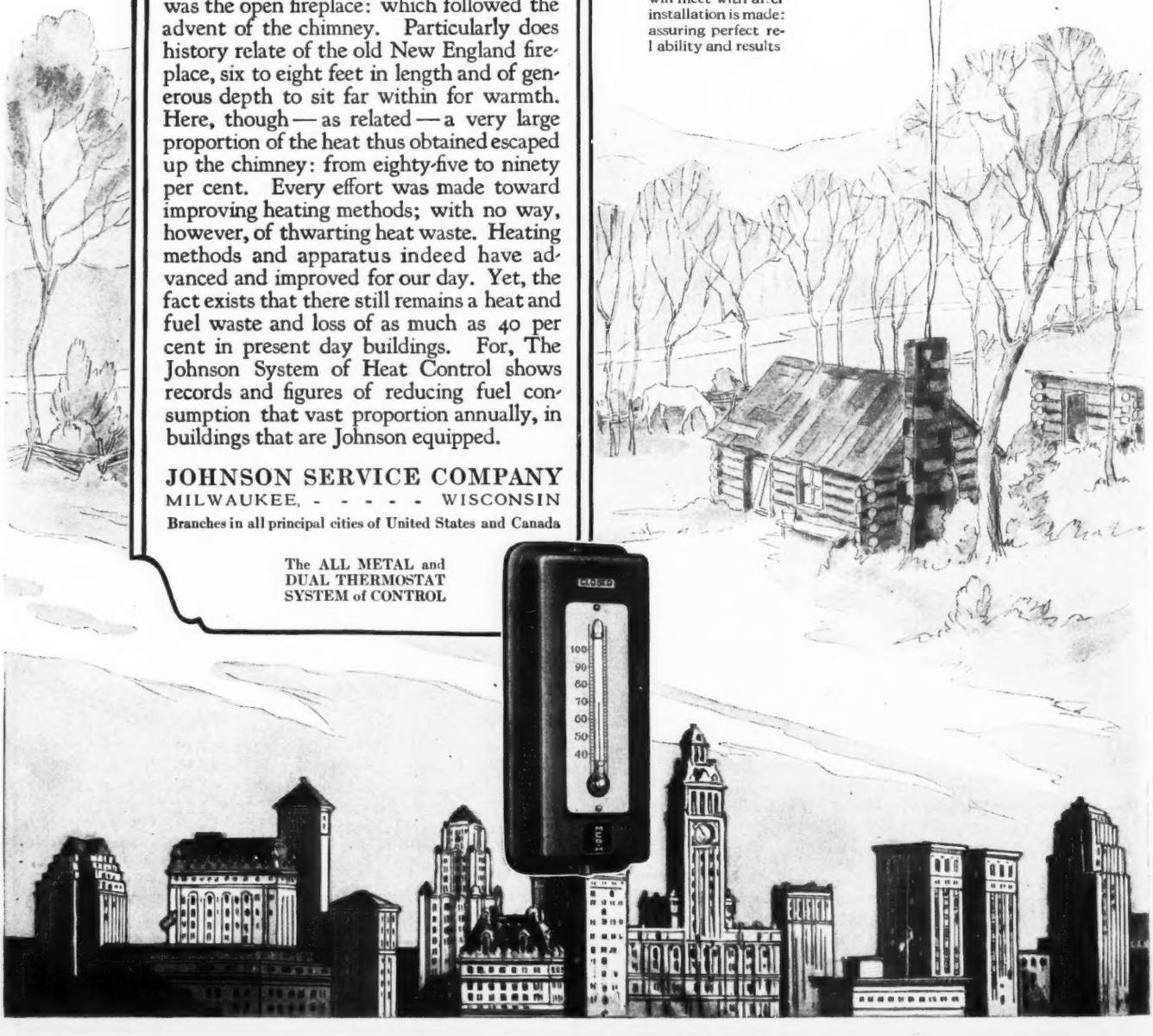



The ALL METAL and DUAL THERMOSTAT SYSTEM of CONTROL

The Heating and Ventilating Magazine

*A Monthly Journal of Engineering Progress*

JUNE, 1927

# The Future of Ventilation

## Importance of Selling Idea to Public with Suggested Method for Duplicating Mild Outdoor Conditions

*By C. F. Wolfsfeld*

OF the many structures that are erected throughout the year, especially those intended for habitation, surprisingly few are equipped with mechanical ventilation. In most cases the main problem seems to be one of heating only. And of those few buildings that have been equipped with such ventilation, an appreciable number today are faring without the operation of their respective systems.

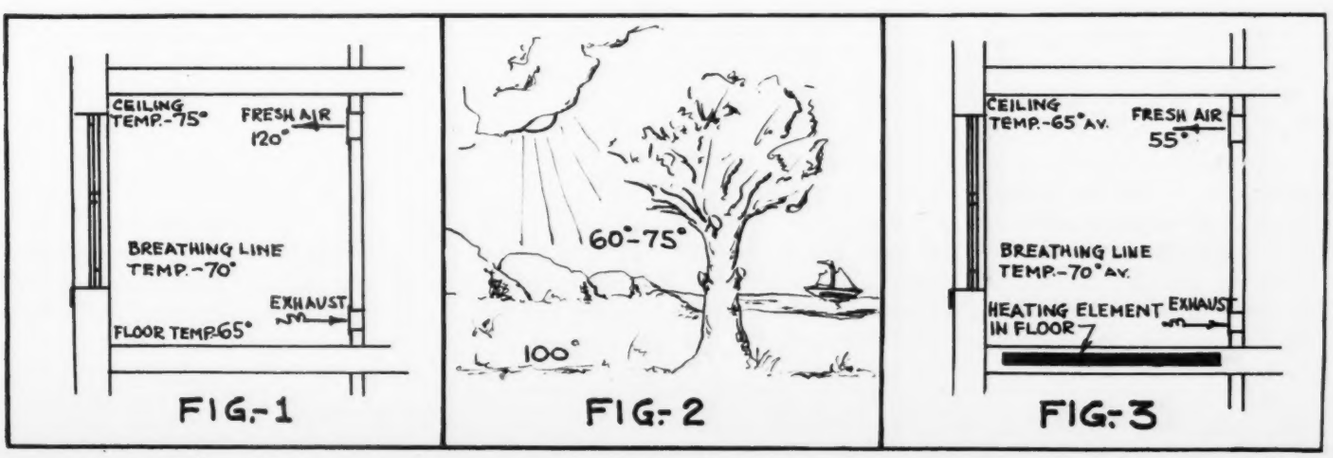
The reasons for the seeming unpopularity of mechanical ventilation as a general institution may be any one or more of the following:

1. Cost of installation excessive.
2. Cost of operation excessive.
3. Cost of maintenance excessive.

These three items, while not strictly engineering reasons, too often are the deciding factors in most structural enterprises. Good ventilation costs more to install than poor ventilation; so does a good building cost more than a poor one—and a good shoe costs more than a poor shoe! Notwithstanding, there are many so-called high-priced shoes being bought every day. Why? Because, as the saying goes, "It's cheaper in the end."

### MECHANICAL VENTILATION MUST BE "SOLD" TO PUBLIC

Does a good ventilation system give so much more, dollar for dollar, than an unsatisfactory one, as to warrant the extra expenditure of installation, maintenance, and operation? Can its superiority be demonstrated to the satisfaction of the architect, owner, corporation, institution, municipality, or even the layman? Can it be brought home to us effectively as in the case of shoes? In the answer to this question, more than in any engineering consideration, lies the future of ventilation. Ventilation, in order to succeed as it deserves to succeed, must be "sold" to the public—to the average layman.




**Comparison of Room Ventilated According to Standard Methods with Outdoor Conditions on a Mild Day and with Room Equipped with "Panel" Heating System**

It has been demonstrated in a number of instances that employees working under good conditions of ventilation do more and better work than under adverse conditions of ventilation. To such employers ventilation has already been sold. To the vast majority of the public, however, ventilation must still be sold. And how shall this be accomplished?

Not long ago, the heating and ventilation profession was given a timely warning. This was the "Open Window Ventilation Controversy." The A.S.H. & V.E. met the issue fairly, squarely, and wisely, by defining proper ventilation in terms of quantity and quality of air, freedom from odors, bacteria, drafts, etc., irrespective of the method by which these characteristics were established. But are we heeding the warning? Wherein lies this warning? It is this: The average layman opens the window when he feels the need for ventilation, whether or not the space which he occupies is mechanically ventilated. And only when he feels the outside air coming in right from its source is his thirst for ventilation appeased.

Call it psychology, imagination, ignorance, or what you may; the fact remains that a certain effect is craved and in this manner satisfied. And the open-window ventilation expert knows this.

The warning to be taken by the engineer from the open-window ventilation trumpet is the need for designing and operating this mechanical ventilation in such a manner that the occupant knows and feels that the space he occupies is being ventilated, and further that under-ventilation must be made conspicuous by its absence.

Take the case of the oscillating desk fan, which, in most cases, simply agitates the air around it. The occupant within the effective radius of the fan feels the periodic gust of wind with its alternate cessation. He feels it come and go; his mind (and to an extent his body) responds to the impulse—the rapid change of conditions. *He knows it is there.*

### MUST DUPLICATE CHARACTERISTICS OF OUTDOOR CONDITIONS

When a concern advertises "Manufactured Weather—Every day a good day," it drives home the fact that outdoor effects must be produced indoors.

A gentle cool breeze, then a pleasant warm zephyr, then a short windstill period, then a little sharper wave at a higher temperature, interspersed with high, medium and low percentages of humidity, and so on; those are the characteristics of pleasant outdoor conditions. Those are the factors that enable us to discern whether or not we are outdoors, even though we be blindfolded.

The A.S.H. & V.E. has listed as one of the essentials of perfect ventilation, "freedom of monotony." This item might well be placed near the top of the list.

The future of ventilation, therefore, lies in the ability of the engineer to enlighten the public as to the advantage of proper ventilation by producing a ventilation system that can be felt in the same pleasant manner that is experienced out-of-doors.

Apropos of the idea of producing Spring-day conditions within a building, one might investigate into Nature's methods.

In Fig. 1 is shown a room mechanically ventilated in one of the standard ways. Air at about 120° F. (for New York City) is admitted near the ceiling, and the room is vented near the floor. For a room of about 12 ft. high the temperature near the ceiling will be about 75° F., that at the floor about 65°, and the temperature at the breathing line will be close to 70°.

Fig. 2 depicts a scene of nature in the pleasant months. The heat of the sun's rays is absorbed by the ground, rendering its surface temperature higher than that of the human body.

Above the ground one experiences air currents at varying mild velocities and ranging in temperature between, say, 60° and 75°. Breezes coming from the waters impart their invigorating bits of moisture and ozone.

A comparison between Figs. 1 and 2 reveals the fact that temperature conditions are largely reversed. Indoors we have a cold floor with warm air above, while outdoors we have a warm floor with cool air above.

Can the heating and ventilating engineer reverse the usual indoor temperature conditions? Were it practicable to turn an actual room upside down, these conditions, approximating those of Nature, would prevail, but only for a few minutes, for, due to the laws of gravity, the warm air would soon rise to the ceiling and the cold air drop to the floor.

Disregarding occupants or loose objects in a room, we could maintain Nature's idea of temperatures by reversing the room every few minutes. This would create a mild, well-distributed air current every time the cool air at the ceiling would fall to the floor.

To duplicate this effect in a practical way we have only to put the heating element in the floor and admit cool, fresh air at various points in the ceiling or through high-velocity jets high in side walls, blowing completely across the ceiling, as shown in Fig. 3. Blowing cool air across the ceiling has the additional advantage of keeping down the heat loss through ceilings of high rooms where same occur under roofs. To duplicate the effect of periodically reversing the room, we must produce a period of air movement every few minutes. This can be done by operating the air supply fan intermittently.

### SUGGESTED CYCLE OF OPERATION

Under such a system the cycles of operation might be as follows:

1. Cool fresh air is admitted for several minutes

at the ceiling and then the fresh air supply cut off.

2. The cool air at the ceiling drops and the air warmed by the heating element in the floor rises, resulting again in a warm ceiling. After this the first cycle is repeated.

Air filtering, washing, humidification and ozonation, all can be applied to the incoming fresh cool air.

Besides the other apparent advantages of such a system, freedom of monotony might be claimed for it.

Where temperature control is desired, this could be effected by regulating the temperature of the fresh air supply. The heating element in the floor, if same consists of hot water coils, can be operated at temperatures to suit the weather. The idea of heat in the floor, walls, etc., has already been employed in the so-called "panel system."

Manifestly, any system of intermittent air supply may interfere with existing laws that require a fixed number of cubic feet of air per minute. In the great campaign for more universal ventilation, however, engineers may recommend a change in such laws. And, better still, they may enact laws or ordinances making operation of ventilating systems compulsory.

A ventilating system that is designed to admit 10 cu. ft. of fresh air per minute per occupant and *is operated,* is better than one that provides 30 cu. ft. per minute and is *not operated!*

While 30 cu. ft. of air per minute per person may be desirable, it usually results in a fairly large plant and consumes what is looked upon as a great deal of fuel.

When an architect or even a layman hears that three to four tons of coal are used for ventilation every time one ton is used for heating, he throws up his hands.

"Well, the law requires the system," sighs the architect. "If they care to run it, they can run it; if not, they can let it rust out!"

When a municipality or an institution decides to build, they are very much in the position of an individual who contemplates buying an automobile.

A well-known manufacturer of boilers advises to "Buy the boiler you can afford to own, not the one you can afford to buy." This message, aptly expressed as it is, deserves to be broadcast, for it applies to almost every purchase.

The prospective car buyer, if he is wise, purchases the car he can afford to keep and run. Why should not a community be justified in asking for a good ventilating system that it can afford to run?

High-pressure campaigns rarely fail to procure funds for the initial building, but the question of maintenance has to be met by yearly taxes. And that's when the shoe pinches!

Perhaps the ventilation system of the future will be smaller and more refined. Perhaps it will deliver less air but better air, placing quality first and quantity last.

And when the public has been educated into the value of good air, they will want more of it!

## Effect of Car Heating System on Shoe Leather

THE Northampton Boot Manufacturers' Association, which represents the most important section of the British boot and shoe manufacturing industry, has written to the London Midland & Scottish Railway, one of the "big four" of the British railway world, concerning the heating of the new dining saloon cars which the line has recently put into service. The heating of these new cars is by means of brass plates which come directly under the feet of passengers, instead of by the method of placing pipes under the seats of the car.

The association has pointed out to the railway that the change may have serious consequences for the public as well as for the boot manufacturers, as passengers using the cars will be in danger of having the soles of their shoes damaged without knowing how the damage has been done. Much less heat than that which comes from the new apparatus installed underfoot in the cars is sufficient, declares the association, to injure the soles of footwear, especially when they are damp—a fact which is not realized by the general public.

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## New British Smoke Abatement Act

AN explanation of the provisions and administration of the Public Health (Smoke Abatement) Act, passed in England last year, and which comes into force on July 1 next, has been addressed to local municipal authorities by the British Ministry of Health. It is recalled that the principal provisions give power to take proceedings in respect to a nuisance from smoke which is not black; extend "smoke" to include soot, ash, grit, and gritty particles; increase penalties, and give power to make by-laws prescribing standards as to the emission of smoke and in respect to cooking and heating arrangements in new buildings other than private dwellings. The new act will give local authorities useful additional powers, but results must depend primarily on good administration.

The Minister of Health has been advised that at present it is impracticable to apply standards to any but black smoke, and the kind of by-law, which it will be possible to make under the section, will provide that there shall be a presumptive of a nuisance if, for example, black smoke is emitted for two minutes in the aggregate within any continuous period of thirty minutes. Although it may not be considered practicable in every district to apply so strict a standard at once, it appears to the Health Minister that, in the absence of special circumstances, it should be the aim gradually to reach this standard. He is of the opinion that by-laws under this section should be made in every considerable industrial district.

# The Cooling and Ventilation of the Minneapolis Auditorium

## Details of an Installation Requiring 413,000 Cu. Ft. of Air per Minute, Cooled by 3,000,000 Gal. of Well-Water per Day

*By S. C. Bloom*

*(From a paper presented before the Chicago Section of the American Society of Refrigerating Engineers)*

### "Effective Temperature" and the Summer "Comfort Zone"

As we know, the "effective temperature" which has been found to be the best average for human beings normally clothed, at rest in still air is 66°. Manifestly, different individuals will require different "effective temperatures" for greatest comfort, and, as a consequence, there has been established a "Zone of Comfort," the boundaries of which are 63° "effective" and 71° "effective." While it has been pretty definitely established that this "zone" is satisfactory for conditions during the heating season, it has not yet been demonstrated that it is equally applicable for summer conditions. In other words, there will probably be required a different "Comfort Zone" for summer.

By choosing an indoor "effective temperature" midway between 66° "effective" and that prevailing outdoors, the necessary readjustment of the body heat-controls would be a minimum, commensurate with the comfort contrasts; and, at the same time, when summer weather moderated to the extent where 66° "effective" outdoors was approached, or reached, the contrasts should be gradually reduced and finally eliminated.

Curiously enough, an examination of the indoor temperature and humidity conditions following this schedule of effective temperatures corresponds very closely to what has been thought desirable, expressed in ordinary terms of temperature and humidity.

To illustrate:

| | | |
|---|---|---|
| Outdoor Condition | | |
| Dry bulb temperature, deg. F..... | 100 | 85 |
| Wet-bulb temperature, deg. F..... | 78 | 65 |
| Relative humidity, per cent..... | 37 | 33 |
| Effective temperature, deg..... | 85.8 | 75.4 |
| Indoor Condition | | |
| Dry-bulb temperature, deg. F..... | 81.4 | 74.6 |
| Wet-bulb temperature, deg. F..... | 69.5 | 64.2 |
| Relative humidity, per cent..... | 54.6 | 55.6 |
| Effective temperature, deg..... | 75.6 | 70.4 |
| Outdoor Effective, temperature | | |
| Plus 66°, divided by 2..... | 75.9 | 70.9 |
| Refrigeration required, per cent... | 100 | 66.7 |

The Minneapolis Auditorium is noteworthy in another respect, for the reason that its specifications were the first wherein guarantees were required involving reference to the "Human Thermometric Chart."

An extract from the guarantee, which the ventilating contractors, H. Kelly & Co., Minneapolis, was required to give, reads as follows: The systems "shall have cooling capacity to maintain in the respective spaces ventilated, when fully occupied, an 'effective temperature' within 1° of the mean between 66° 'effective temperature' and the 'effective temperature' then prevailing in the outdoor air, whenever same exceeds said 66°."

"'Effective temperature' shall be determined from dry-bulb and wet-bulb thermometer readings referred to the American Society of Heating and Ventilating Engineers, 1925, Human Thermometric Chart for Normally-Clothed Individuals, at rest in air of zero velocity."

Undoubtedly, some such form of guarantee soon will be commonly required in connection with every cooling system; for the reason that it covers the entire range of summer conditions, rather than the extreme condition alone, which is the one upon which guarantees are more commonly based when requiring some definite temperature and humidity in the building.

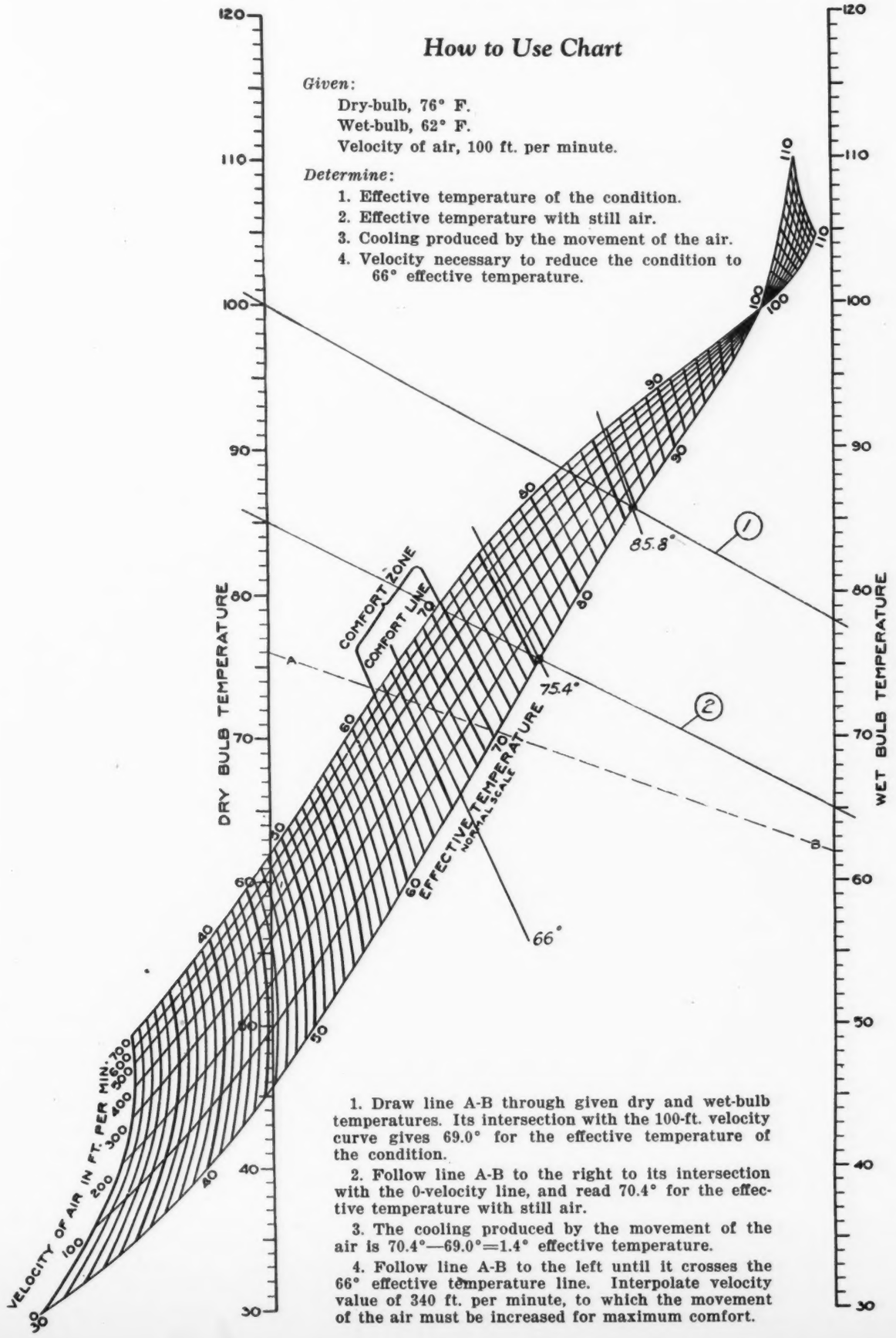
### OZONE EQUIPMENT WILL BE USED TO ELIMINATE TOBACCO SMOKE

Another feature of interest which will be embodied in all the ventilating systems of this structure, when the balance of the building is constructed, is the use of ozone equipment in connection with the air supply at all times of the year.

On account of the unique method of cooling and washing the air recirculated in the Minneapolis Auditorium systems, there is no need for ozone for the purpose of freshening and vitalizing the air introduced; but, with great numbers of people smoking, the amount of air which it is practical to use for ventilation without drafts is insufficient to provide good visibility. In large structures, where the distances from the most remote seats

# Thermometric Chart for Human Beings at Rest and Normally Clothed

Compiled by C. P. Yaglou and W. Edw. Miller from tests conducted at the A.S.H. & V.E. Research Laboratory, F. Paul Anderson, director, in co-operation with the U. S. Bureau of Mines, Pittsburgh, Pa.


How to Use Chart
Given:
Dry-bulb, 76° F.
Wet-bulb, 62° F.
Velocity of air, 100 ft. per minute.
Determine:
1. Effective temperature of the condition.
2. Effective temperature with still air.
3. Cooling produced by the movement of the air.
4. Velocity necessary to reduce the condition to 66° effective temperature.
DRY BULB TEMPERATURE
WET BULB TEMPERATURE
COMFORT ZONE
COMFORT LINE
EFFECTIVE TEMPERATURE NORMAL SCALE
VELOCITY OF AIR IN FT. PER MIN.
85.8°
75.4°
66°
A
B
1
2
1. Draw line A-B through given dry and wet-bulb temperatures. Its intersection with the 100-ft. velocity curve gives 69.0° for the effective temperature of the condition.
2. Follow line A-B to the right to its intersection with the 0-velocity line, and read 70.4° for the effective temperature with still air.
3. The cooling produced by the movement of the air is 70.4°—69.0°=1.4° effective temperature.
4. Follow line A-B to the left until it crosses the 66° effective temperature line. Interpolate velocity value of 340 ft. per minute, to which the movement of the air must be increased for maximum comfort.

# What "Effective Temperature" Means

THE need of a factor which would combine the comfort effects of air temperature, humidity and motion in their various combinations has long been felt. Heating, ventilating and refrigerating engineers are well aware of the fact that there are many combinations of these three factors which produce like effects.

It remained for the Research Laboratory of the American Society of Heating and Ventilating Engineers, under the direction of Dean F. Paul Anderson, co-operating with the U. S. Bureau of Mines, to attack and solve this problem.

Subjects were placed first in an air-conditioned chamber, where the air was still and saturated with moisture; that is, 100% relative humidity. In a similar chamber adjoining, higher temperatures and lower humidities and various degrees of air motion could be maintained; and the subjects passed back and forth from the first to the second chamber, adjustments of the air conditions being made in the second until the subjects reported an equal degree of comfort in both. The dry-bulb temperature, wet-bulb temperature and air motion in the second chamber was then said to have an "effective temperature" equal to that in the first chamber.

Thus the original chamber would be maintained at, say, 70° F. and various combinations of temperature humidity and air motion produced in the second chamber, until a series of combinations was obtained, and readings noted. Each combination of the series was then said to have an "effective temperature" of 70°.

In like manner, the temperature of the original chamber was varied throughout a great range and for each value a new series of combinations in the second chamber maintained until at last the "effective temperature" range between 30° and 110° had been explored and the combinations of temperature, humidity and motion producing these "effective temperatures" determined. Air movement ranged from 0 to 700 ft. per minute velocity, for again it is our common experience that, with a given temperature and humidity in summer, we feel cooler under the grateful breezes from an electric fan.

GREATEST CONTRIBUTION TO ART

This work is unquestionably the greatest contribution to the art of air conditioning in its broadest sense which has appeared in a generation, and should be thoroughly understood by every engineer concerned with the effect of air conditions upon human comfort. To illustrate more fully: Take 76° "effective temperature," for example. A few of the combinations of temperature and humidity which afford this "effective temperature" in *still air* upon an average person at rest and normally clothed, are shown in the following table:

| | | | | |
|---|---|---|---|---|
| Dry-bulb, deg. F. | 95. | 90. | 85. | 80. |
| Wet-bulb, deg. F. | 56. | 60. | 66.5 | 71.8 |
| Relative humidity, per cent | 2.5 | 13. | 37. | 67. |

To go further into the matter and see the influence of moving air upon a person, with combinations of temperature and humidity, which produce the same 76° "effective temperature," let us examine the combinations at 700 ft. per minute air velocity. The table follows:

| | | | | |
|---|---|---|---|---|
| Dry-bulb, deg. F. | 100 | 95 | 90 | 85 |
| Wet-bulb, deg. F. | 57.5 | 65.5 | 73.5 | 81.2 |
| Relative humidity, per cent | 1 | 18 | 45.5 | 87 |

It is evident that all these combinations *for still air*, or *moving air* at 700 ft. per minute velocity, or at any other velocities within that range, would not be equally healthful, even though they were equally comfortable. Steady drafts are highly objectionable to those who have a choice in the matter, hence it is advisable to consider *only* combinations of temperature and humidity which, *in still air*, will give the desired "effective temperature."

The "effective temperature" found to be best in still air, for the average human being at rest and normally clothed, was 66°.—S. C. Bloom.

to the stage are very great, it is highly important that visibility be good. Ozone in concentrations of one part in 5,000,000 parts of air will keep it free from smoke, as well as from the pronounced odors from smoking; thus as an aid to ventilation its use becomes highly important in this kind of building.

In systems where air is recirculated, *without* being thoroughly washed, the percentage which can be recirculated is limited, due to the banking up of body odors, tobacco smoke, etc., which makes the use of ozone equipment imperative, in order that the operating economies, incidental to a high percentage of recirculation during the entire year, may be realized.

REFRIGERATING EFFECT OF WELL-WATER

The refrigerating effect which will be obtained from the cold, well-water used in the eight principal air supply systems, aggregating 413,000 cu. ft. of air per minute capacity, will amount to the equivalent of 1,000 tons ice melting. It is difficult to comprehend the significance of this figure until one stops to think that if ice had to be used to maintain the spray water at 50° F., instead of drawing upon the bounty of Nature, the amount of ice required would be sufficient to supply the normal requirements of a population of 250,000 people, or the combined population of the following Illinois cities: Peoria, Springfield, Joliet, Oak Park and Evanston, in extreme summer weather.

The volume of water pumped from the wells will be at the rate of 3,000,000 gal. per day, a quantity sufficient for the water supply for a city the size of Belleville, Ill. It might be remarked in passing that it would take the entire output of ten ice plants of the size needed to meet the requirements of the same city in hottest weather.

Figuring on an estimated operating period of 12 hours per day, 100 days per year, 144,000,000 gal. would be pumped. With electric power at one cent per kilowatt hour, the cost of water is estimated at $2500 per annum.

(*Continued on Page* 62)

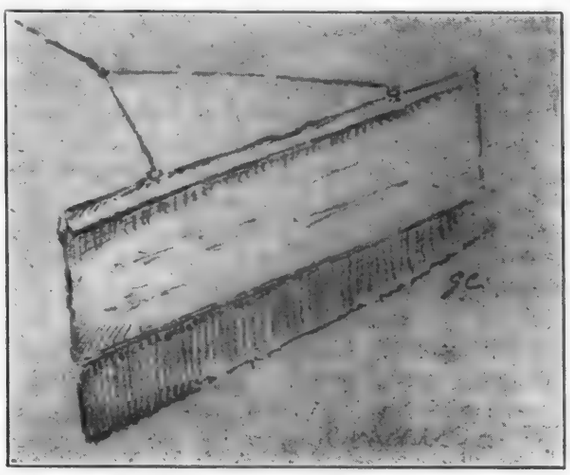
# Keeping Cool in India

## Time-Honored Expedients Used in a Hot Climate to Relieve Oppressive Air Conditions Include Punkahs, Tatties and Thermantidotes

*By George Cecil*

ON the days when the British first occupied India, little attempt was made to cool the heated bungalow, officers' mess, kutcheri (court of justice), and merchant's office, beyond employing a native to wave a huge palm-leaf fan to and fro. The perspiring sahib (white man) and his wife and children were content to face the pestiferous "hot weather" atmosphere as best they could. Knowing that the "cold weather," which lasts from early in October till late in March, would make them forget the horrors of red-hot days and equally unpleasant nights, they were buoyed up by hope, which, according to the poet, "springs eternal." The poor exiles certainly deserved the respite afforded by winter.

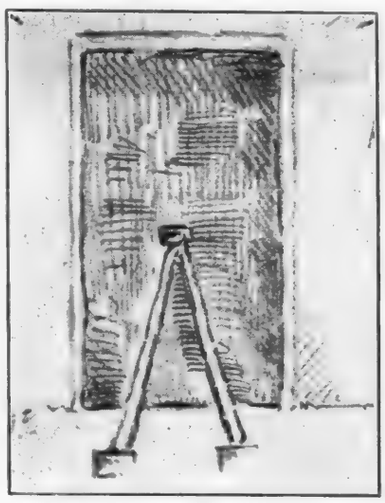
Early in the last century, a Scotch missionary, a corpulent divine, who suffered greatly from the appalling heat, determined to get the better of the white resident's natural enemy, and, in due course, he evolved the punkah, which for over a hundred years, has proved a boon to the European inhabitants. A pole, some 15 ft. in length, is attached to two ropes, about 3½ ft. long, the extremities



**The Punkah, India's First Substitute for the Palm Leaf Fan**

being secured to a ceiling beam. The pole which is furnished with a heavy double fringe of weighted calico has a short rope at both ends, these being connected with a longer one which, passing through a hole in the wall, or over a small grooved wheel, is held by the punkah-wallah, a patient native, who gently pulls it. The result is a refreshingly cool breeze—unless the *coolie*, as often happens, drops off to sleep.

Sometimes the punka-wallah ties the rope to his big toe, and, wooing slumber hopes that the punkah will, on the perpetual motion principle, continue to swing. If it does not do so for many minutes, a volley of abuse from the interior of the bungalow awakes Ram Lal, who immediately pulls for dear life. Nothing tries the sahib's temper more than sleeplessness, and none can rest in comfort when the artificial breeze dies away. The native, thriving on "hot-weather" days and nights, considers his infuriated employer a lunatic.



**Khuss-Khuss Tattie, Composed of Water-Soaked Fragrant Grass Which Frames the Doorway**

Winter having set in, the frill is put away for six months. Should the calico be left in position, it harbors snakes and scorpions, which, dropping on the floor, greatly disturb the equanimity of those who are in the room. Death quickly follows snake-bite.

### "TATTIES" AND "THERMANTIDOTES"

Additional coolness is secured by closing every door in the bungalow (there are no windows) the moment the blazing sun is high in the heavens, the idea being to shut out the warm air, or the doors are taken off their hinges, a "tattie" (a wooden frame-work on which khuss-khuss, a fragrant grass, is bound) filling the space. Water is poured over the grass at intervals and, the wind catching it, the rooms are kept more or less cool. Should the air remain exasperatingly still, the white people make the most of the punkah and pray that before long a hurricane will blow. Sometimes their prayers are heard, for dust storms are not uncommon.

There also is the "thermantidote," a most ingenious contrivance which has been in use over fifty years. A door at the end of the room is removed and a very broad wheel, which is covered

with khuss-khuss grass, is installed in its place. Water drips continually on the "thermantidote," two natives turn a handle and a cooling zephyr plays on the occupants. The labor is extremely fatiguing and relays of colored men are required; a twenty-minute shift being much as each pair can stand. The first and second-class carriages of the trains, by the way, are provided with *tatties* in the "hot weather;" deprived of them no European can be expected to survive the journey, especially when the thermometer registers 120° F. in the shade. Frequently the water supply gives out.

Occasionally, a sahib dies of heat apoplexy in the compartment, especially should he be of full habit and too much given to whiskey and soda, a panacea in which some Anglo-Indians have unlimited faith. They seldom live to retire and settle in their native land.

Although the "punkah," the "tattie," and the "thermantidote" are found necessary all over India, and probably will remain so until doomsday, in the large towns electric fans have ousted them. Calcutta business houses, bungalows, shops, and government offices have been fitted with these fans. Bombay, ever jealous of Calcutta's superior commercial importance, has followed suit. Madras is equally up-to-date. Elsewhere the electric fan has replaced the oldtime methods, much to the annoyance of the coolies who formerly earned their living at the end of the rope, by turning a handle, or by keeping the tatties damp. The native's occupation, like Othello's, is gone.

Ice plays its part and an important one, too, in cooling the Anglo-Indians and their surroundings. Rupees permitting, large blocks of ice are placed about the sitting-room during the most heated hours of the day. This particular luxury is, however, limited, for the exiles spend as little as possible in India. They make it their business to save money with a view to an early return to England —there to remain. To the average European the East is devoid of that glamour about which ill-balanced poets sing in mellifluous accents. The "hot weather" is the curse of India.

When the heat is at its worst, the exiles sometimes venture on an iced bath. They may not live to repeat the experiment often, for it results in danger to the vital organs—a foolhardy proceeding.

## The Cooling and Ventilation of the Minneapolis Auditorium

(*Continued From Page* 60)

To evaluate this wonderful natural asset of Minneapolis, consider that a strictly modern mechanical refrigerating plant of the carbon-dioxide type, having 1000 tons capacity per day, would cost $125,000, installed complete. This would really have been a matter of little consequence, even if it had been necessary to install it, for the additional outlay would be only 2½% on the total cost of the Minneapolis project. And it still would be necessary to pump the same volume of well-water for condensing purposes for a refrigerating plant of this size.

Such a plant would require 800 H.P. to drive it. Figuring the same operating time per year and the same power cost per kilowatt, the annual power bill for driving the ice machines would be $5400. Capitalizing this at 6%, it amounts to $90,000. Adding the original cost of a refrigerating machine results in a total of $215,000 as the value of the cold well-water supply to the city of Minneapolis in connection with its auditorium. As a matter of fact, it is really worth considerably more, since depreciation, repairs, interest and supplies such as oil, carbon-dioxide gas, etc., and attendance have not been figured and capitalized. No doubt a quarter of a million dollars would be a more accurate figure to set for the value of the well-water supply.

### MINNEAPOLIS AUDITORIUM, WHEN FILLED, GIVES OFF 8,000,000 B.T.U. PER HOUR

It is difficult for the average person to imagine the enormous amount of heat which must be taken care of in theatres, auditoriums, and the like. Let us take the Main Arena and Orchestra Hall section of the Minneapolis Auditorium, with a joint seating capacity of 15,000 people. In round figures, the amount of heat thrown off by such a crowd is 6,000,000 B.T.U. per hour. To this must be added an additional 2,000,000 B.T.U., representing heat from electric lights, transmission through the walls of the structure, due to the lower temperature maintained in the auditorium. This makes a grand total of 8,000,000 B.T.U. per hour.

This is the equivalent heat output of a 240-H.P. steam boiler which, with an average overall efficiency of 67%, would require 10 tons of Pocahontas coal per day. Just fancy, for a moment, using ice to quench the heat given up from this amount of coal burned. The average home-owner will burn anywhere from 10 to 15 tons of coal per heating season, which provides a standard of comparison which is easily grasped.

In the design and construction of this great structure the architects and engineers, Messrs. Croft & Boerner, of Minneapolis, have symbolized the spirit and character of the community and of the vast territory of which it is the metropolis. The Minneapolis Auditorium has no "Queen Anne" front and "Mary Anne" back, but, standing four-square, is equally imposing from any angle. There has been achieved a nicety of balance between beauty and utility, which is the hall-mark of genius in its designers and ranks them among the nation's foremost architects.

Donald M. Forfar, engineer associated with the architects, who made the complete mechanical design, has met his problem intelligently and with a boldness of conception which reflects great credit upon him. The drawings and specifications covering the mechanical equipment were models of clarity and completeness, evidencing the thoroughness of his handling. It was the author's privilege to co-operate with him on the major features of the cooling and ventilation.

# The Chemistry of Oil Combustion

## Present-Day Theory Identifies Gasified Hydrocarbons as an Elementary Fuel

By P. E. Fansler

Associate Editor, THE HEATING AND VENTILATING MAGAZINE

HEAT is a form of energy and its utilization, in various forms, constitutes the greater part of all of the forms of energy used by man. Heat may be the result of friction between bodies, of an electric current or of chemical reaction. A chemical reaction is the result of the bringing together of two or more elements or compounds where these constituents unite in new forms of elements or compounds. Where such reaction is accompanied by both heat and light, combustion is said to have occurred. It must not hastily be assumed from this definition that combustion is the inevitable result of the production of light and heat; both of these phenomena result from the passage of an electric current through the filament of an incandescent lamp, yet, because no chemical change has taken place, combustion has not occurred.

We are prone to think of combustion as meaning oxidation, yet this is not strictly correct, because heat and light result from the chemical reaction between yellow phosphorus and bromine vapor, and no oxygen is involved. Yet, considering the firing of liquid fuels, oxygen is the agent and we will, therefore, confine our consideration to reactions between combustibles and oxygen. Chemical reactions are always accompanied by heat, which may be produced by the reaction, *or required for its consummation.* And these reactions can be expressed as simple, arithmetical equations.

### OIL FUEL DOES NOT BURN—EXCEPT IN GASEOUS FORM

It must be remembered that, while we are considering what we call the combustion of oil fuels, we are, in reality, concerned with such fuels in their gaseous state, in other words, what are technically called "gaseous hydrocarbons." We may quickly arrive at the correct viewpoint by considering that the prime function of an oil burner is to convert liquid fuels (hydrocarbons) into these gaseous hydrocarbons. Secondary, although necessary functions are related to the control of the rate of production of gas, to its automatic production only at such times as it may be required, to securing reliable ignition for initiating combustion of the gas and to proper means of safeguarding the operation of the entire mechanism.

The study of combustion goes back to the beginning of history. So far back as the eighth century Geber, a half-mythical Arab, made such determinations as led him to state that combustion could not take place without air. This early research might be expected, for the production and utilization of heat formed one of the most important problems of primitive man. From that day to the present men have delved into the intricacies of chemistry and physics, with the result that combustion results can now be calculated, or predetermined, with the greatest accuracy.

### DEVELOPMENT OF THE CHEMISTRY OF COMBUSTION

Inasmuch as the burning of oil fuel may involve combustion of carbon, it is interesting to note the development that has taken place in the theories advanced during the last half century. As recently as Civil War times, the theory was held that the initial result of the combustion of carbon and oxygen was the production of carbon-dioxide, $CO_2$, and that with an additional supply of carbon this was reduced to the monoxide form, thus:

$$C + O_2 = CO_2$$

and then

$$CO_2 + C = 2CO$$

In 1872, Sir Lowthian Bell, after many experiments and much study expressed his belief that just the reverse took place, that carbon-monoxide was the chief if not the exclusive result of combustion, the dioxide being then formed if an excess of oxygen were present. It is interesting to note that contemporary and slightly later investigators corroborated this theory.

However, about fourteen years ago, Rhead and Wheeler, as a result of exhaustive research work, found that they could not check completely with either of the earlier theories and they advanced what is known as the "carbon complex" theory, which is generally accepted to-day and which is not controverted by any known fact. This theory holds that the first product of combustion is a loosely formed and unstable combination of carbon and oxygen of unknown formula which may be represented by $C_xO_y$. This, it is assumed, results from the "fixation" of such oxygen molecules as come into contact with the carbon.

It is probable that the carbon molecule is extremely complex in structure and it is suggested that the impact of the oxygen accompanying combustion may actually result in an atomic rearrangement. However that may be, it is held that some temporary arrangement is effected, and the repeated "fixation" of oxygen generates heat until at last sufficient oxygen has been involved to cause

the unit that has been forming to become $CO_2$. In the chaos involved in the chemical reaction that is taking place, some of these completed molecules become disassociated and, being unable to acquire additional oxygen within the confines where it is available under sufficient heat, become carbon-monoxide. The only carbon-monoxide, then, that may appear in the final analysis, is that which escapes from the combustion space under conditions of low temperature and insufficient oxygen. This process of "fixation" continues if sufficient oxygen is available, until all forms below $CO_2$ become saturated with oxygen to that point.

We may then consider that when the combustion of solid carbon with oxygen from the air takes place, the reaction may be expressed as $C_x + O_y = CO_2 + CO + C_xO_y$, and that later during the period of combustion the $C_xO_y$ breaks down into an indeterminate division of $CO_2$ and CO, depending largely upon the conditions under which combustion is taking place, the temperature involved and whether or not there is an excess of carbon or of oxygen.

It is but natural that nearly all of these early investigations mainly considered the combustion of carbon, as, until very recent years, coal was the prime combustible.

The increasing importance of fluid fuels, chief among which are petroleums, natural and manufactured gas, has greatly broadened the scope of combustion problems, and brought about investigations into these new fields.

## COMBUSTION OF THE THREE ELEMENTARY FUELS

In a classic treatise, "Fuels and their Combustion," Haslam and Wheeler have grouped all of the complex fuels found in nature into three simple or elementary fuels: 1—solid carbon, 2—gaseous hydrocarbon, and 3—a mixture of carbon-monoxide plus hydrogen. Combustion may involve one or more of the elementary fuels. Frequently a natural fuel is broken down into the elementary fuel just prior to actual combustion, the two steps being so intimately associated that the decomposition of the complex fuel is almost a part of the combustion process.

Coal, as an example, goes through a process of distillation or coking, after being fired. The products of this distillation are gaseous hydrocarbon, carbon-monoxide and hydrogen, while solid carbon in the form of coke is left behind. Each of these three elementary fuels forms the basis of a simple combustion reaction which may be considered and computed separately.

In the case of the combustion of oil fuel, it is interesting to note that there are two possible paths or ways for combustion to take place. Oil fuel being essentially a liquid hydrocarbon needs only to be gasified by having its temperature raised above its boiling point to form a perfect elementary fuel—gaseous hydrocarbon. If now, sufficient oxygen be provided, with means for intimately mixing it with the gaseous hydrocarbon thus produced, and the mixture raised to the ignition point, combustion will be complete, and simple in form, following the elementary process. If, however, insufficient oxygen is provided, the liquid hydrocarbon will, as a result of being heated, "crack" or decompose thermally into carbon and hydrogen, the indication of which is a smoking flame. Thus it is evident that under this condition of imperfect functioning of an oil burner, there is a combustion complex similar to that encountered in burning coal.

Turning to a consideration of the combustion of hydrocarbons, the second of the elementary fuels, we find that a similar condition exists in that three distinct theories have been advanced to explain this combustion. A hydrocarbon essentially is composed of two combustible elements, hydrogen and carbon and, until thirty-five years ago, the theory prevailed that in the oxidation of the molecules, the hydrogen was more susceptible to the action of the oxygen, and that this combination took place before the oxidation of the carbon.

## HYDROXYLATION—THE MODERN COMBUSTION THEORY

The theory appeared plausible until researches of H. B. Dixon and others produced experimental evidence indicating that, when a hydrocarbon was oxidized, the initial action took place between the carbon atoms and the oxygen, leaving the combustion of the hydrogen to follow. This problem formed the basis of elaborate researches by Bone and others who developed what is called the "hydroxylation" theory, which has supplanted the two earlier ideas and is, to-day, generally accepted as properly expressing the reaction.

The experiments upon which this concept is based indicate that when a hydrocarbon is combined with oxygen there is an undeterminable preliminary association of the hydrocarbon molecule with an unknown amount of oxygen, forming an indefinite oxy-hydro-carbon compound of the form of alcohols and aldehydes, which later are further oxidized and converted into carbon monoxide or carbon dioxide and water.

The step-by-step process is probably variable and is not well understood, but all evidence points to the transformation of the hydrocarbon molecule, through the addition of oxygen, into an alcohol (of the form $C_xH_xOH$), and this, with the addition of more oxygen forms an aldehyde (of the form $CH_x$ CHO), which, with yet more oxygen reaches the formaldehyde stage (H.CHO). Then, depending upon the amount of oxygen present, this formaldehyde either is broken down by heat, forming carbon dioxide and hydrogen, or, with oxygen present, further combustion may transform it into carbon monoxide and water, or carbon dioxide and water. In this chain-like transformation, it is highly desirable that there be present sufficient oxygen, under favorable conditions, so that all of the hydrocarbon may be converted into formaldehyde; otherwise free carbon will result, which means smoke.

### HYDROCARBON COMBUSTION A RACE BETWEEN "CRACKING" AND HYDROXYLATION

Where we are dealing with the heavier oil fuels, it must be realized that the tendency to "crack" through thermal action, into either carbon and hydrogen, or into lighter hydrocarbons, necessitates careful design of a burner to handle these fuels. In any given condition, it is a question whether the breakdown of the hydrocarbon can be forestalled by the initiation of hydroxylation.

By preheating the oil and air, and by thorough atomization, with a definite and complete mixing of the atomized oil and air, conditions can be made favorable for the chemical reaction that is desired; failure in this regard will see the formation of free carbon, or soot. Thus it will be appreciated that the mechanical elements involved in providing for combustion are quite as important as the proper thermal setting.

### WHAT ARE IGNITION TEMPERATURES?

The point to which the temperature of the combustible elements must be raised to produce rapid combustion without the further addition of heat is called the ignition temperature. When this point is reached, the heat generated by the chemical reaction between the elements is produced at a higher rate than it is dissipated, and combustion therefore continues on a self-supporting basis.

Suppose that acetylene gas $C_2H_2$ and air issue from a nozzle into an inert gas, such as nitrogen. Imagine a ring of platinum to be so placed that it surrounds the issuing jet, close to the nozzle, and connected so that it can be heated with an electric current. If this gas mixture is emitted from the nozzle and the ring slowly heated, there will come a point when the temperature of the gas, as it passes through the ring, will approach 765° F., which is the lower limit of the ignition temperature range of acetylene and air. Somewhere just below this temperature, depending upon the details of the set-up, a flame will gradually come into being. If, at the instant that the flame is observed, the electric current is cut off from the ring, and if the ring is of such small mass that it quickly cools, the flame will die out; the temperature was not high enough to *establish* combustion. The radiation from the flame carried the heat away faster at that temperature, than it was generated.

If, now, the experiment is repeated, and carried along until the ignition point is reached and passed, the ring can be cooled and a jet of flame will continue as long as the gas-air mixture is supplied—combustion has been established. There is, for many combustibles, no exact fixed ignition temperature; it has only been determined between limits—for acetylene and air, for example, within the range of 765° F. to 820° F.

Acetylene gas was taken as an example as it is one of the intermediate stages in the combustion of gaseous hydrocarbons, or gasified oil-fuel.

The ignition temperatures generally accepted, for the more common gases in air are as follows:

| Gas | | Ignition Temperature Degrees F. |
|---|---|---|
| Gas-oil gas | | 337 |
| Acetaldehyde | | 365 |
| Kerosene gas | | 563 |
| Light paraffin base crude-oil gas | | 600 |
| Ether | | 750 |
| Gasolene | $(C_2H_5)_2O$ | 770 |
| Acetylene | $C_2H_2$ | 765-820 |
| Ethane | $C_2H_6$ | 960-1160 |
| Ethylene | $C_2H_4$ | 980-1015 |
| Hydrogen | H | 1070-1080 |
| Carbon monoxide | CO | 1180-1210 |
| Methane | $CH_4$ | 1200-1375 |

Ignition temperatures are commonly supposed to be dependent only upon the composition of the combustible elements, but it is evident that they are also dependent upon the conditions under which the reaction takes place, that is to say, the factors governing dissipation of the heat generated by the combustion.

Moreover, the ignition temperature of a gas is assumed to be that at which continuous combustion will be initiated *with the exact mixture of gas and air required for combustion.* Any excess air will naturally act as a diluent, raising the ignition point of this mixture, and if excess air is too great, it even may prevent the attainment of the desired end.

The direct application of this phenomenon to the oil burner lies in the fact that from 40% to 100% excess air is usually supplied by a mechanical-draft burner, and the advantage of decreasing this for the period of ignition is evident. This is particularly true where heavier oils are being atomized.

As combustion must be initiated at a point, enough heat must be produced at that point or made available from an outside source to heat the gas in a small surrounding sphere to the ignition point, and the combustion of this must be passed on to successive envelopes until the limits of available gases are reached.

### EXCESS AIR PROBLEM ALSO BOTHERS DIESEL-ENGINE DESIGNERS

This question of excess air is also proving a serious stumbling block in the design of Diesel engines of the air-injection type as, under conventional ratings, it is necessary to provide for a cylinder displacement about 75% in excess of the volume of air required for complete combustion of the fuel injected at full load. This means, of course, that the entire engine must be built considerably larger than theoretical dimensions, and if it can be discovered how to secure homogeneous mixtures of air and atomized oil in the minute span of time allotted for this phase of the cycle, the design and manufacture of such engines can materially be changed and much lower prices made possible.

It is, therefore, evident that at least one of the problems confronting the oil burner industry is very closely paralleled in another major line of the world's endeavor.

*The concluding installment of this article will appear in the next issue.*

# PIPECRAFT

## PART V

EVERY pipe system should have metal pipe sleeves where passing through walls, floors or other building construction. In some cities these are required by law, but in other localities they are left to the steamfitter, who is under obligation to provide a first-class, "workmanlike" job.

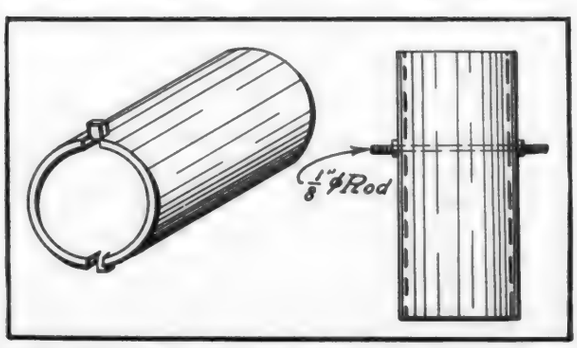
In the ordinary residence of frame construction these sleeves may be made of galvanized sheet-iron, with a little turn-over of ½-in. to ¾-in. at the top and bottom. The customary practice is to make such sleeves, suitable for the various standard pipe sizes, in the shop, and to have them a little longer than necessary. After they have been delivered to the job and are ready to be set, it is a very easy thing to take the tinsmith's snips and trim the sleeves so they will project about ¾-in. below the finished ceiling. After the plastering is completed the snips can again be used and a number of little cuts made around the projecting end to the sleeve so as to divide it up into small sections which can be turned back against the ceiling plaster with the fingers.

On more pretentious work, with fire-proof construction, it is customary to use a stronger sleeve. In fact, specifications for such work frequently call for the sleeves to consist of standard-weight pipe two sizes larger than the pipe to go through the sleeve.

This is not a particularly adroit way to phrase such a requirement for, on a 1-in. pipe, this would only mean a sleeve of 1½-in. size to comply with the specification, while for an 8-in. pipe the sleeve would have to be 12-in. The clearance on the 1-in. size would be almost too little, and for the 8-in. size it certainly is too much. A much better designation would be to require the inside diameter of the sleeve not less than ½-in. larger than the outside diameter of the pipe.

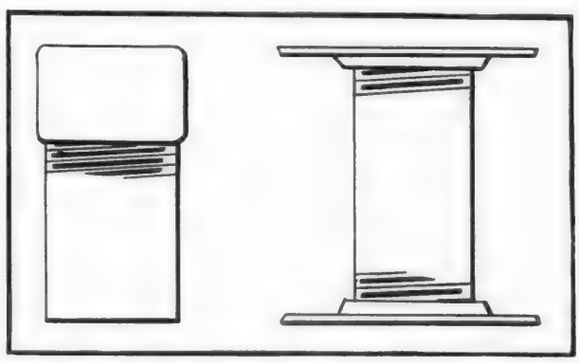
### Pipe Sleeves Falling Out of Concrete Slabs

Difficulty has been experienced with sleeves cut from pipe when cast into concrete, owing to the fact that the concrete sometimes dries out in time and loses its cling on the sleeve. This allows the sleeve to drop out of the slab and slip down the riser until arrested by striking the next pipe fitting below. The intercepting fitting is often the tee for the radiator runout on the floor below, and the appearance of a lot of runout tees, with pipe sleeves flopping loosely around the riser immediately above, can easily be imagined as far from artistic, in any sense of the word.




Figs. 33 and 34. Means for Preventing Pipe Sleeves from Dropping

A pipe sleeve before being set should have some mechanical projection on it to prevent its dropping out of the construction at some later date. The little flange on the top of the simple galvanized sheet-iron sleeve previously described is quite sufficient. Other patented telescopic sheet-iron sleeves also satisfactorily meet this requirement. Straight pieces of pipe, however, do not, as the outside is perfectly smooth.



Figs. 35 and 36. Other Methods of Holding Pipe Sleeves in Place

Various ideas have been tried out in an endeavor to get around this fault, such as cutting two notches down into the top of the sleeve and bending out the sections of the metal between the cuts, as shown in Fig. 33. Another scheme, illustrated in Fig. 34, is to drill a 3/16-in. hole and to put a short length of ⅛-in. threaded bolt through the hole with a nut on the outside to keep it in place. After the concrete is set, a cold chisel is used to cut out the portion of the ⅛-in. bolt obstructing the sleeve, leaving the portion imbedded in the concrete and extending to the inside of the pipe sleeve intact.

By far the best solution, which is shown in Fig. 35, is to use a pipe coupling screwed on the top end, but this can be improved upon where it is desired to stand up sleeves in a concrete form ready for casting in with the concrete. Here both ends of the sleeve are threaded and common floor flanges are screwed onto both top and bottom, as seen in Fig. 36. If the thread on the top of the sleeve is made a running thread about 3-in. long, adjust-

ment can be secured later by screwing the flange down on the sleeve and cutting off the sleeve projection with a hack saw or by chopping it off with a cold chisel. The bottom flange is nailed to the concrete form with fairly heavy nails and after the form is pulled off the projecting ends of the nails are clipped off.

## Pipe Covering

The use of pipe covering on exposed risers hardly ever proves satisfactory in the long run. Where necessary to cover exposed risers they should, by all means, be canvas-jacketed with 8-oz. canvas and preferably enclosed in galvanized-iron casings to prevent damage to the covering from crushing.

Concealed risers always should be covered, but canvas-jacketing is really not necessary in such cases, beyond the canvas commonly supplied with the covering and proper banding with the usual bands. Many specifications insist on recanvasing concealed risers, probably with the idea of protecting the covering until the pipes are furred in and covered up.

The covering of concealed risers is done more for the protection of the plastering over the pipes than for any heat saving that might be obtained in the risers. Risers in chases and behind furring, unless covered, will dry out the adjacent plaster too quickly when heat is turned on and are very liable to crack the plaster. Of course, there is some saving in heat, too, so that this practice is doubly beneficial.

All fittings should be covered with plastic asbestos and pipe bends will best be handled by wrapping first with chicken wire and then troweling plastic asbestos over this. Such bends also should be canvas-jacketed to prevent the movement of the bend from cracking the plastic and allowing it to fall off after it has hardened.

## Double Runouts

Economy often dictates the taking of the two radiator connections off the same riser at the same floor level. For concealed risers a double radiator connection customarily is made, as shown in Fig. 37, which allows both branches to be properly pitched. Of course, a suitable increase in size of branch must be made between the riser and the first takeoff.

Another scheme, although a little more expensive, is to use two separate tees in the riser or drop. These are placed one above the other and each runout is for a single radiator. In this case the details already shown for single radiators would apply.

Double runouts of this sort should never be made with a bull-head tee, as shown in Fig. 38, for these reasons: First, because the use of bull-head fittings is prohibited in nearly all specifications; second, because (even if permitted by the specifications) their use is objectionable, owing to the butting together of opposing flows, one against the other, and, third, because it is impossible to pitch both branches without the use of crooked threads.

With exposed risers and runouts below the floor the scheme shown in Fig. 38 would be equally satisfactory, but if the runouts are placed above the floor the projection out into the room would be in the way, so some other idea must be used.

One solution is to come out on the far side of the riser and then put in a tee and break back around the riser (passing either to the back of the riser, if room permits, or in front of the riser, if necessay) to hook up with the second radiator.

A more expensive way but at the same time a nicer method, especially for top-connection radiators, is shown in Fig. 39, where two tees are placed in the riser, one above the other, and simple single radiator connections are run from each. Unfortunately, this scheme usually will not work with return connections, as it brings the upper return branch too high up unless legless or wall radiators are used, supported on the wall higher than the ordinary radiator.

## Valving and Draining Risers

All risers and drops, except for the cheapest residence work, should be valved somewhere between the main and the vertical line. Valves should be

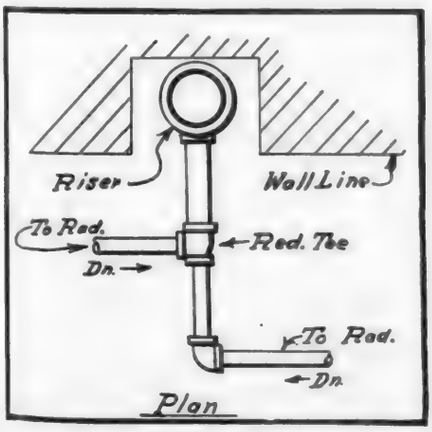



Fig. 37. Double Runout at Same Floor Level from Same Riser

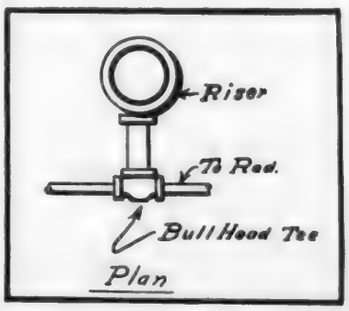



Fig. 38. Improper Use of Bull-Head Tee on Double Runout

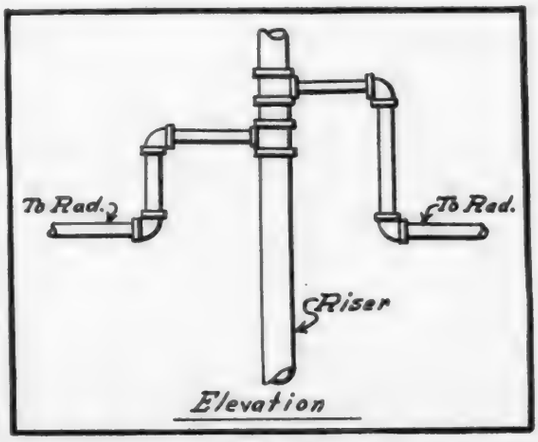



Fig. 39. Design of Double Runout for Top-Connection Radiators

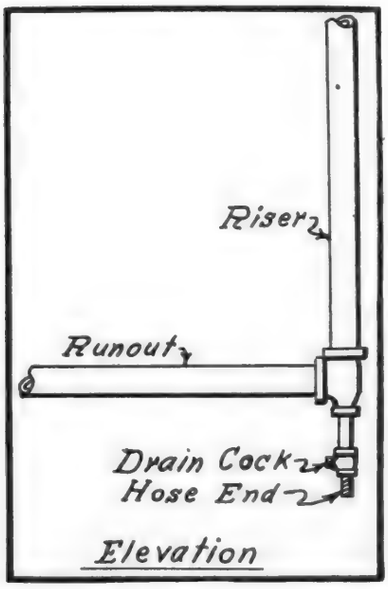



**Fig. 40. Hose Connection at Bottom of Hot Water Riser**

such as to interpose no obstruction to the flow of steam or water and, therefore, must be of the gate type.

Hot-water risers or drops also should be provided with drains at the bottom, with drain cocks, and these should be run, if possible, to some sink or floor drain so that the riser can be drained off without the use of pails. If this is impossible, then the drain should terminate in a hose thread to which a hose may be attached and run to any convenient drain point. See Fig. 40.

## Horizontal Offsets in Risers or Drops

With the growing practice of "set-backs" in building construction as the stories rise higher and higher above the street, the matter of horizontal offsets in the vertical piping assumes greater importance. Where lines on the interior columns and walls can be run up practically straight, the lines on the outside walls—which include most of the heating risers—must break back from time to time as best they can. This, no doubt, is a big help in providing for expansion, but it is also a care and expense, in many cases, to make the offset in a satisfactory manner.

If the risers or drops are exposed, it is only necessary to run back on the ceiling until the proper point is reached and then punch a hole in the ceiling so as to continue the pipe on up, as illustrated in Fig. 41. But where lines are concealed it is not so easy; furred ceilings let the heating lines out of a lot of difficulty, as shown in Fig. 42. Where no furring exists, the roof fill must be resorted to, unless false beams can be constructed on the ceiling to hide the cross-overs.

At any point where it is necessary to run a steam or return line through concrete construction—such as a roof fill or floor fill—every effort should be made to leave the pipe free for movement without interference by the concrete. This may be accomplished by leaving a slot through the concrete considerably larger than the pipe, but, if the depth of the concrete is not sufficient to permit a substantial cover over the slot, some means requiring less room must be devised.

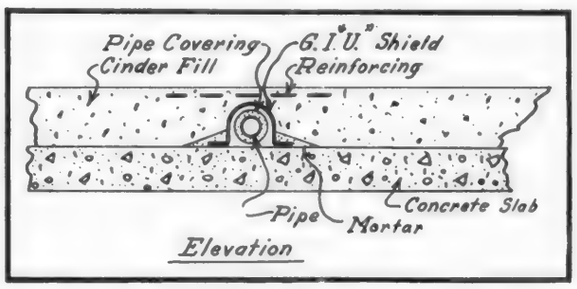



**Fig. 43. U-Shield for Pipe Running in Concrete**

Sometimes this is done by the use of galvanized-iron covers of a semi-circular shape which are put over the pipe to keep the concrete away from the line. A typical installation of this character is shown in Fig. 43. The mode of procedure is to lay the line on the top of the rough concrete, blocked up with the necessary grade to properly pitch the pipe, and also to allow the placing of covering

(*Continued on Page* 77)

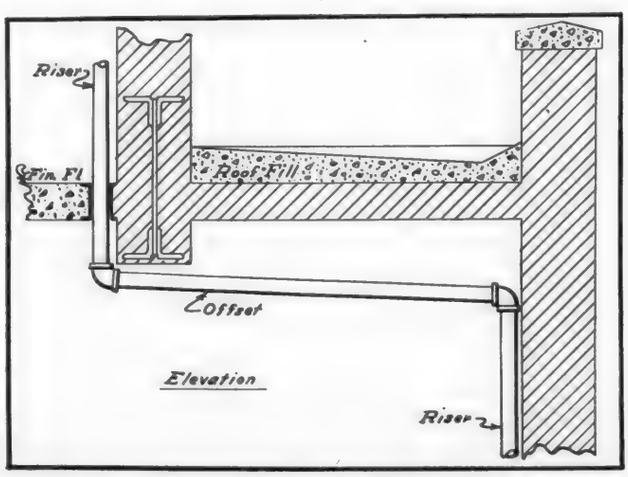



**Fig. 41. Horizontal Offsets in Exposed Risers**

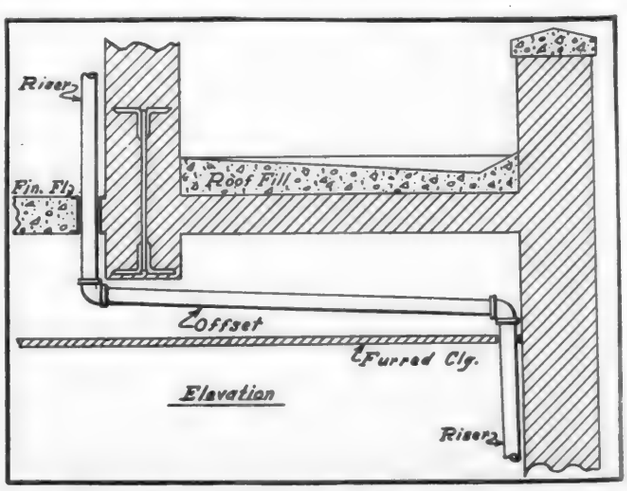



**Fig. 42. Use of Furred Ceilings for Concealing Riser Offsets**

*This is the twenty-fourth lesson of*
*The Heating and Ventilating Magazine's*

# New Home-Study Course in Gravity Steam and Water Heating

## Lesson No. 24 (continued)—Steam and Water Boilers*

*By Ara Marcus Daniels*

IN Fig. B-1-4 is shown a steel firebox boiler of the portable up-draft type, while Fig. B-1-5 illustrates a down-draft boiler of this same type. These boilers are assembled at the factory and are handled during installation as a complete unit. The grate and combustion chamber above it are surrounded by a water-jacketed firebox. Thus, a large amount of direct heating surface is exposed to the fire and gases of combustion. The portable firebox boiler of the smokeless type does not differ greatly from the up-draft portable firebox type, except in the number of grates and arrangement of combustion chamber. As with the cast-iron smokeless type, an inclined hollow-cast upper grate, filled with water, is provided above the ordinary lower rocking-type grate and excellent combustion is assured, as explained above, for the cast-iron type.

In Fig. B-1-6 is shown a steel, firebox boiler of the brickset up-draft type. Fig. B-1-7 illustrates the same type of boiler in the smokeless or down-draft pattern.

### Work Problem B-1-9

The preceding steel heating boilers are constructed with riveted joints. Electrically-welded steel heating boilers are illustrated in Figs. B-1-8, B-1-9, B-1-10, and B-1-11. The boiler shown in Fig. B-1-8 is built especially for residence work. It is constructed on the same combustion principle as the boiler shown in Fig. B-1-11, described below. The boiler illustrated in Fig. B-1-9 is a direct-draft portable firebox welded steel boiler, while those illustrated in Figs. B-1-10 and B-1-11 are of the same type but embody the smokeless feature without the use of a double grate. They contain an intermediate firebrick arch or curtain with a circulating pipe filled with water which connects with the longitudinal water legs. This firebrick arch and pipe extend across the firebox. Openings are provided in the firebrick curtain through which the volatile gases from the freshly-fired fuel pass to meet and mingle with the higher temperature, and more nearly complete combustion from the live fire at the rear of the grate is obtained. In the type shown as Fig. B-1-10 the gases of combustion pass through a central flue to a front smoke-box and thence through the fire tubes to the rear smoke-box and to the smoke pipe and chimney. In the type shown in Fig. B-1-11, the central arch of boiler in Fig. B-1-10 is replaced by a lower row of fire tubes connecting the firebox tube sheet and the front tube sheet through which the gases pass to the front

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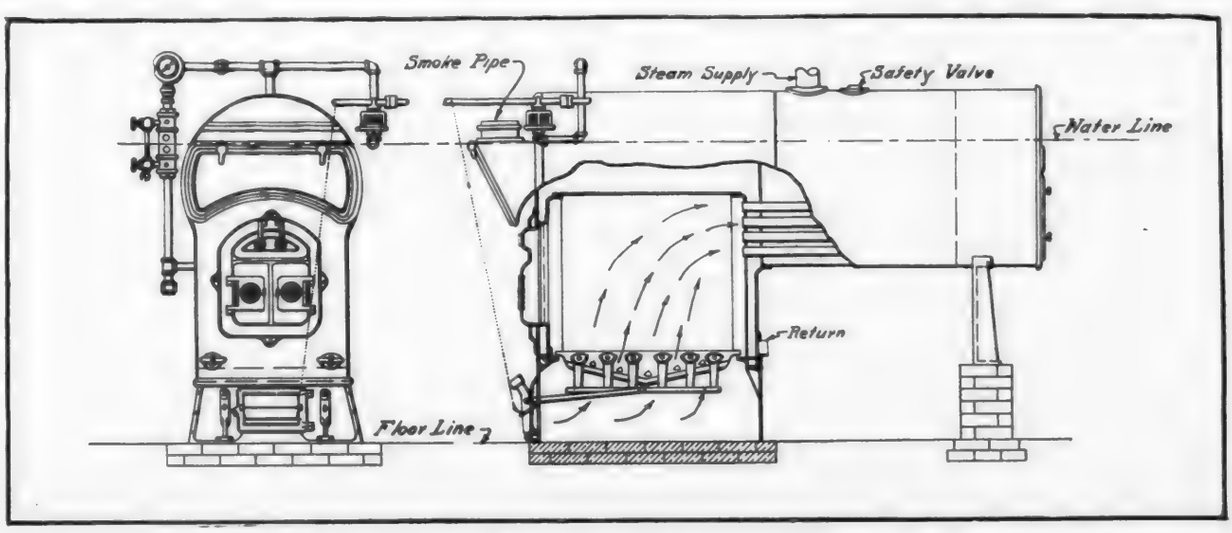


**Fig. B-1-4. Steel Firebox Boiler of Portable Up-Draft Type**

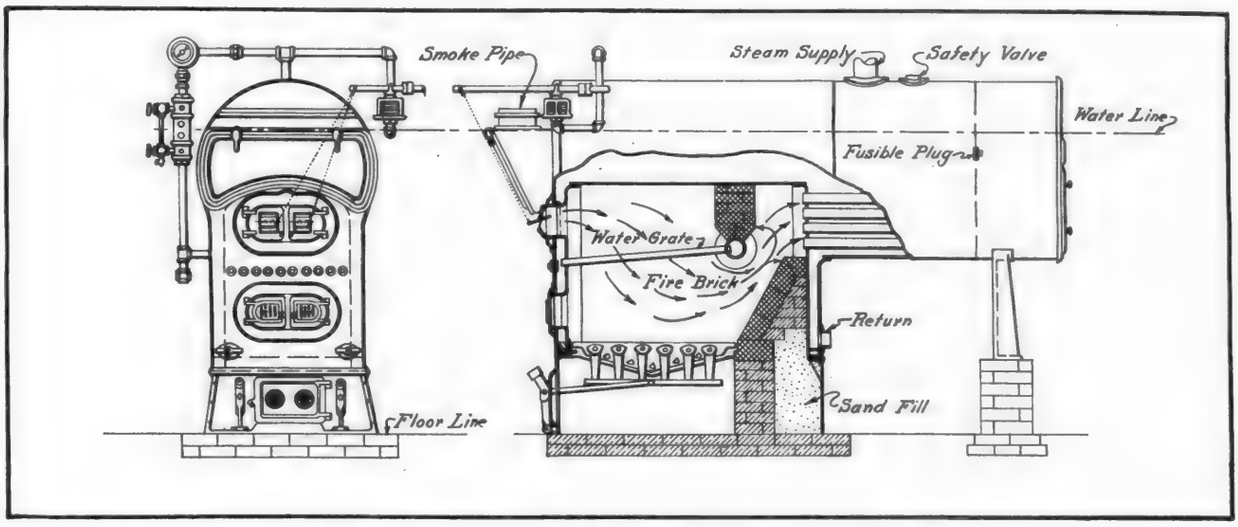


**Fig. B-1-5. Steel Firebox Boiler of Portable Down-Draft Type**

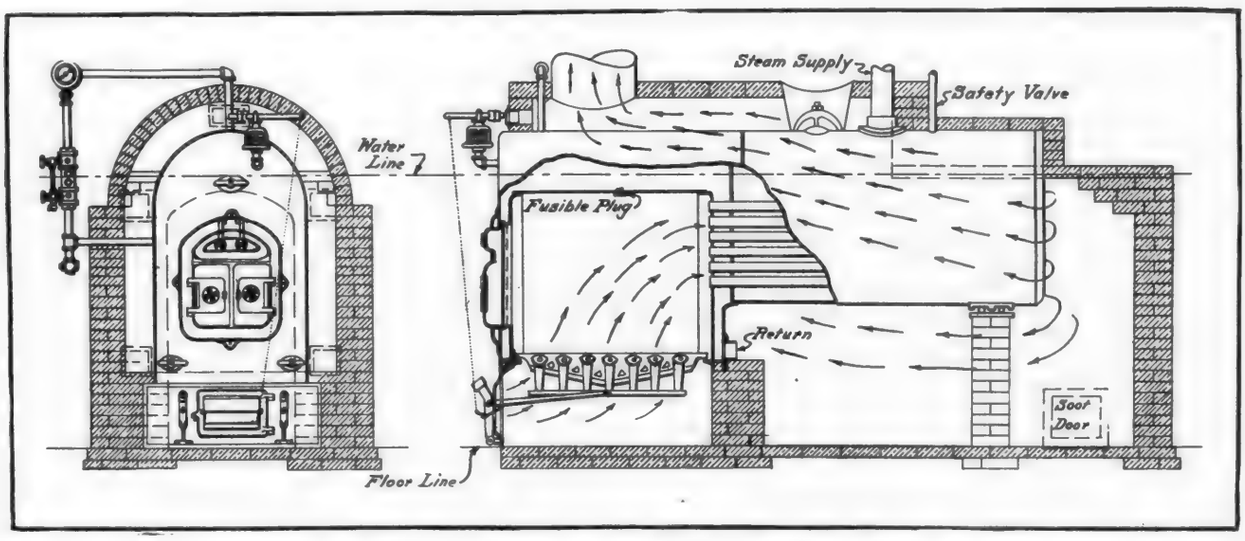


**Fig. B-1-6. Steel Firebox Boiler of Brickset Up-Draft Type**

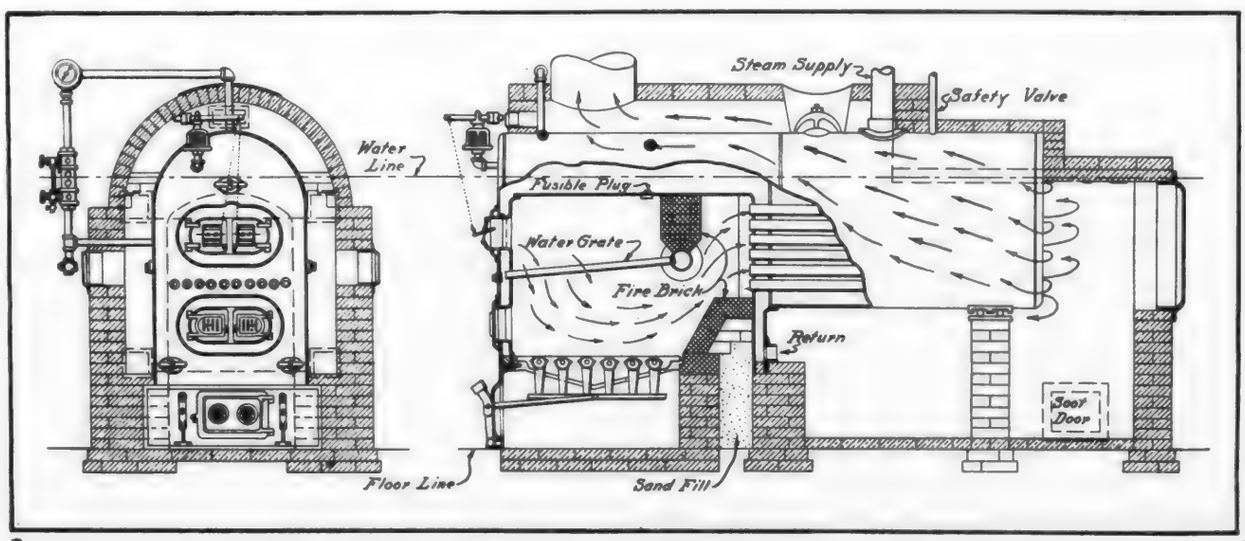


**Fig. B-1-7. Steel Firebox Boiler of Brickset Down-Draft Type**

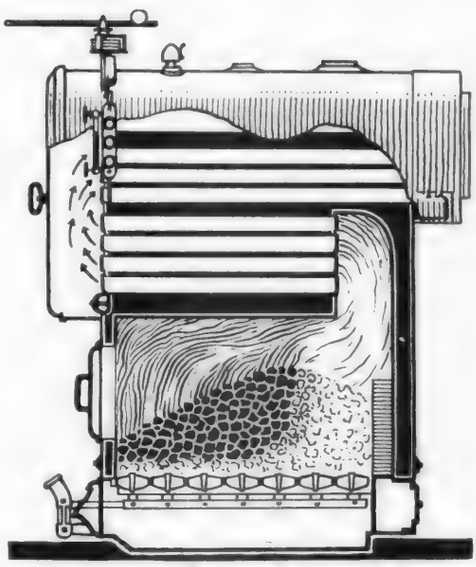

**Fig. B-1-8. Electrically-Welded Steel Boiler, Residence Type**

smoke-box, then back through the upper row of tubes to the rear smoke-box and chimney.

**Work Problem B-1-10**

RETURN-TUBULAR BOILERS

The boiler of Fig. B-1-9 and B-1-11 are really return-tubular boilers of the firebox type. Return-tubular boilers, however, generally are thought of as large steel cylinders provided with heads or "tube sheets" into which the fire-tubes are expanded and with the furnace exterior to the boiler, it being constructed directly below the front third of the shell. The shell is enclosed in a brick-setting. (See Fig. B-1-12.) The gases thus pass first to the rear along the bottom part of the shell, are then turned back by the boiler setting and returned through the fire tubes to a front smoke-box and then to the up-take and chimney. This type of boiler is built as a high-pressure boiler for operation at 100 lbs. per sq. inch and higher when specified. It is seldom considered for heating service until boiler requirements exceed 3000 sq. ft. of direct radiation.

**Work Problem B-1-11**

WATER-TUBE BOILERS

While the steel heating boilers, shown in preceding illustrations, are of the fire-tube design, so-called because the gases from the fire pass through the tubes, there are also types, both in the cast-iron and steel patterns, in which tubes or hollow castings are filled with water and the gases circulate around the outside instead of passing through. Thus the name water-tube boiler. They are built for supplying water or steam radiation.

**Work Problem B-1-12**

COIL WATER-TUBE STEEL BOILERS

In Fig. B-1-13 is shown a coil water-tube steel heating boiler. It is available for coal, oil or gas burning, and is built for furnishing steam or water to heating systems and for hot water supply to faucets for domestic laundry or similar uses.

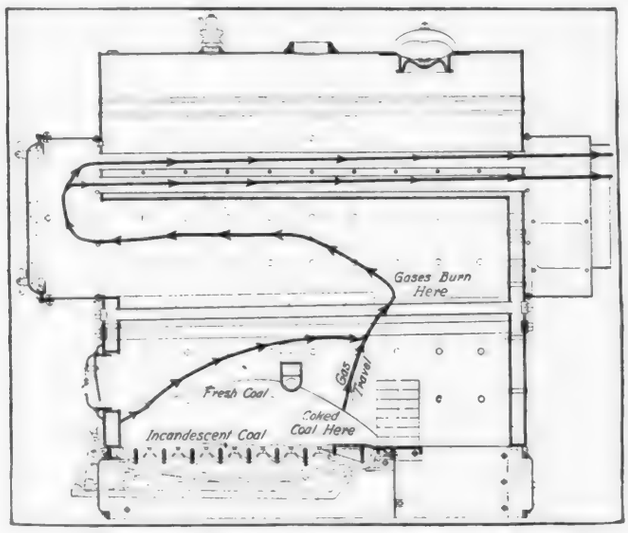


**Fig. B-1-10. Portable Firebox Welded Steel Boiler, Smokeless Type**

GAS-FIRED BOILERS

In Fig. B-1-14 is shown an equipped gas boiler suitable for natural or manufactured gas, while Fig. B-1-15 illustrates the construction of this boiler. It consists essentially of series of water tubes having thin walls exposed to the heat of combustion. Each section of tubes is provided with an individual burner. The iron sections are assembled with cast-iron nipples and held by tie-rods. This type of boiler is metal jacketed and effectively insulated. It is built for steam, vapor and water

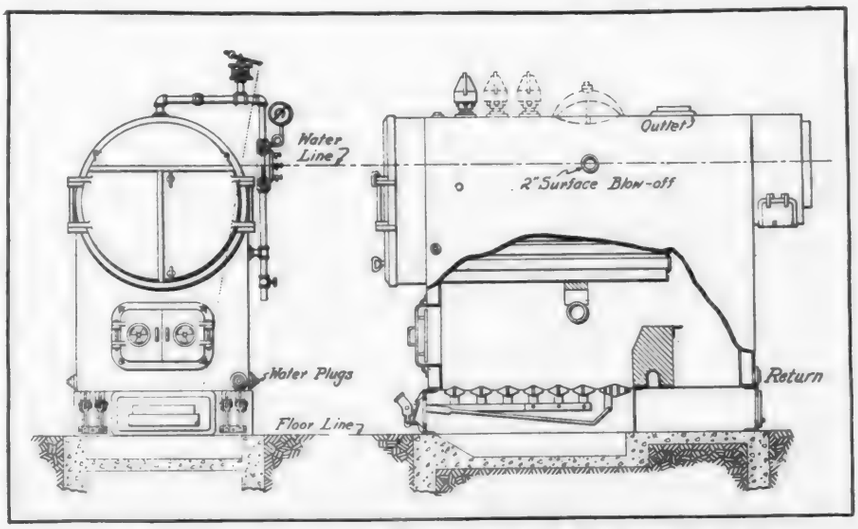


**Fig. B-1-11. Portable Firebox Welded Steel Boiler with Smoke-Consuming Arch**

Fig. B-1-9 is identical in every respect with the exception of the smoke-consuming arch.

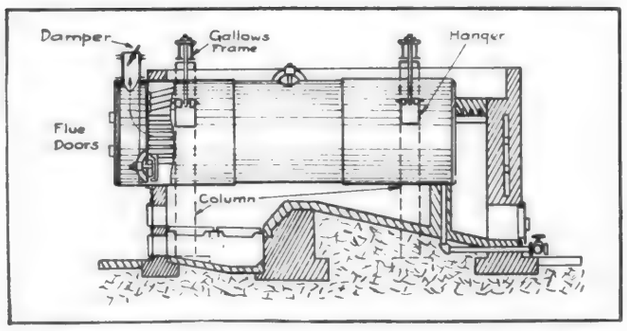


**Fig. B-1-12. Brickset Return-Tubular Boiler**

heating system service and also for use for storage or automatic hot water supply service.

**Work Problem B-1-13**

BOILER HEATING SURFACE

Boiler heating surface is considered as direct or indirect surface. Direct heating surface is designated as that surface which receives the direct heat rays from the fire. Indirect heating surface is that surface which is in contact with the flue gases only. As the name implies, direct heating surface is the more effective and hence more valuable in a boiler. Both direct and indirect heating surface must have water on the side opposite to that where heat is applied. Heating surface is expressed in square feet.

The duty of a boiler is to transmit the heat in the fuel consumed to the water. Hence the capacity or ability of a boiler to do this depends upon the amount of heat transmitting surface in contact with the water in the boiler on the one side, and the fire and hot gases on the other side, and upon the temperature difference between these two sides. Rapid circulation of the water on one side and the heat on the other side is important. Preferably, this circulation should be in opposite direction. Heat absorption in heating boilers should be expected to vary from 1800 to 2400 B.T.U. per square foot per hour.

**Work Problem B-1-14**

BOILER GRATE SURFACE

Boiler grate surface is that surface on which the fuel is placed to be burned. It is the horizontal area occupied by the grates and is expressed usually in square feet, although it may be given in square inches. Grate surface is an important consideration and should be checked in the selection of a heating boiler. There is a maximum rate at which coal can be burned in a given boiler under given conditions of installation, and where the total heat loss to be supplied by the boiler has been determined with care, and a knowledge of combustion rates is had, proper boiler selection becomes, at once, better assured.

**Work Problem B-1-15**

RATIO—H. S. TO G. S.

The ratio of heating surface to grate surface is a term that is frequently used when considering and studying boiler requirements and operation. It is merely a number representing the quotient obtained by dividing the actual heating surface in square feet by the grate area in square feet.

**Work Problem B-1-16**

FIRE-POT CAPACITY

The capacity of any fire pot from grate level to middle of fire door should be ample to hold the amount of coal required for at least an 8-hr. firing period, plus at least 20% reserve for use in igniting a fresh charge.

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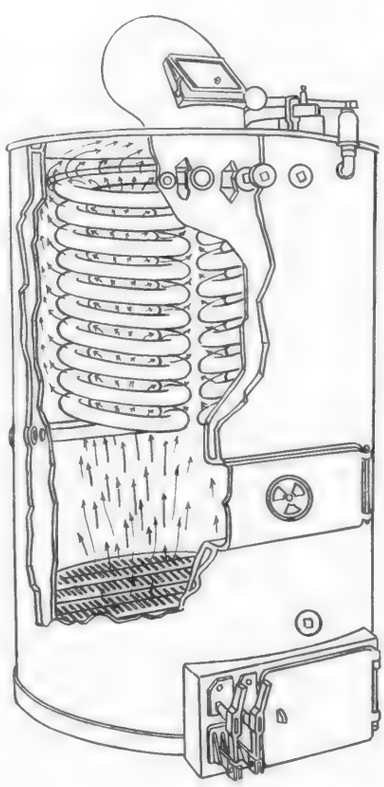

**Fig. B-1-13. Coil Water-Tube Steel Heating Boiler**

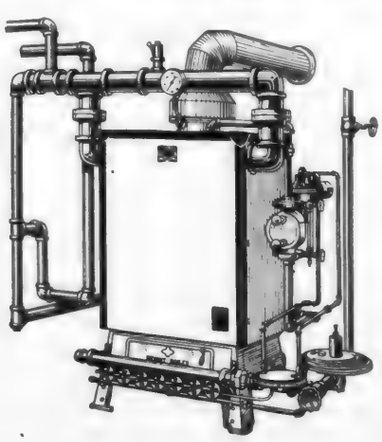

**Fig. B-1-14 (at left). Typical Gas-Fired Boiler**

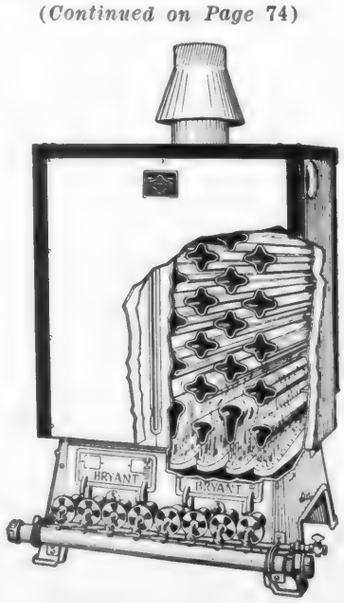


**Fig. B-1-15 (at right). Construction Features of Gas-Fired Boiler**

# The Mechanical Ventilation of the St. Louis Schools

*By Edwin S. Hallett*
Chief Engineer, St. Louis Board of Education

## Part VII—The Value of Trained Operators

ALL the criticisms of mechanical ventilation, when investigated, indicate a failure in a large measure, of the man in charge. No portion of the school building can be erected to pass the ordinary city ordinance inspection without years of apprenticeship and technical study. Electricians, machinists, steamfitters, boilermakers and plumbers, require much theoretical and practical training, and the results of their work require a careful check-up to avoid unsafe conditions. Yet this same machinery is expected to run safely and satisfactorily under the supervision of a man of no experience and training. The contract system of employment of janitorial force in vogue in most of the large cities contemplates this very absurd condition. Even the open-window gravity vent contemplates taking a large portion of the time of 25 school teachers who have skill in teaching but none in ventilation! Efficiency in this case would demand that one room be closed and that the teacher qualify on comfortable ventilation and devote all her time to that work. The pupils would profit immensely by that change.

In St. Louis it takes about five years of apprenticeship as second man in a school to qualify as head man, with sufficient experience and training to handle such a school. What, then, must be the state of affairs in schools that require no training or have no examinations to test the qualifications of the applicant? It would seem that these arguments on ventilation should stop for a while to give the janitors a chance to learn something of the duties of plant operation. It is not true that mechanical plants require more skill than others. On the contrary, the later plants, which are based upon the scientific data of the research departments, require much less skill because the design has built the brains into the machine, instead of depending upon chance to hire them by the month.

### THE ST. LOUIS SCHOOL FOR CUSTODIANS

In the St. Louis school for custodians, which has been in operation for more than eight years, the new employee is placed in second command and is a pupil of the head man. These custodians meet regularly for specific instruction in the operation and maintenance of the plant. Not only are lectures given upon every phase of the management of the school property, but demonstration classes are formed for the solution of difficult and unsolved tasks. Just now the emphasis is upon burning smokelessly and economically the low-grade soft coal screenings. The special type of hand or semi-automatic stokers come in for a lot of study. How to bank the fires, how to start quickly and how to control the fires without wasting fuel are receiving general attention.

The most important phase of this teaching has been the gradual growth of the class spirit of the men. They have come to recognize that the school and general management is resulting in a better working condition for them. As the men have more skill they also have more leisure and easier times. They get pleasure from the knowledge of better work done. The permanent tenure of office and fair promotion and the absence of politics make the position one very much to be desired. The men are very close to the officers of the department. Having the schools manned with employees of such ability and attitude toward the task, it is apparent that a better class of service can be rendered with any type of heating plant than otherwise could be done. The calls on the office for help at present are negligible. Likewise criticism of the service from the teaching staff is nearly unknown.

### WHAT POSITION SHALL THE SUPERINTENDENT TAKE?

Many superintendents, in recent months, have been drawn into the discussion of this subject and are at sea, but what of the future? In deciding any question it is necessary to go to those whose business it is to be informed.

For health we consult the physician or surgeon; for legal difficulties we call the attorney, and so forth. The matter of ventilation is strictly a scientific problem. Those who object to the air passing through a fan and say that thereby it loses some of its vital properties, can not explain how, and must resort to the doctrine of the witch doctor or some other hocus pocus to justify their position. There are not two theories of ventilation. All the facts that have been discovered relative to the subject make up a consistent procedure that must control the engineer in the design and operation of ventilating plants.

Every item of construction of a schoolroom is now the result of precise information as exact and compelling as the stress diagrams of a bridge. The floor and wall materials are selected by the most exacting rules. The ceiling heights are determined

by the room width and the window sizes by the floor areas. The ventilation is in this same category, and the most exacting conditions as to the several elements of school air conditions must be observed and produced. Nothing may be left to chance.

### THE SUPERINTENDENT'S GREAT CONCERN

The fact uppermost in the mind of the superintendent of schools is the health of the children. If there be an optimum of air condition as affecting the health of the school, this element alone will control his decision. The annual death rate of the large cities varies more than 50% from the lowest to the highest. What causes such wide variation? Why should Cleveland, O., have the lowest, 10 per thousand, and Cincinnati more than 16 per thousand? Practically the same State laws are in effect to promote health, and other controls indirectly affect the health. It would seem to eliminate all variables except atmospheric conditions. The contrast is favorable to Cleveland in that the prevailing winds are from the north, off the lake, and the dust and smoke are carried inland, whereas Cincinnati, having soft coal and low wind motion, carries a heavy smoke pall at all times. The very fact that a contrasted air condition coincides with a greatly divergent death rate indicates a health element in the air conditions. The same contrast occurs in whole State reports on health. This being true, it must follow that some atmospheric conditions are more healthful than others.

The American Society of Heating and Ventilating Engineers has devoted all its resources and scientific research to the answer to all such questions, and no other authority or body is comparable in the value of such studies. The open-window gravity scheme is destitute of every element of adequate ventilation and does not produce health conditions as declared by the New York Commission on Ventilation.

The comfort zone is a zone of varying temperatures, humidity and air motion that shall give the sensation of equal comfort. Every move in ventilation in the future must take cognizance of these facts. Every installation in the future must make provision for the control of these variables by automatic or other reliable means. Any other condition means discomfort and the consequent loss of mental output.

### A NEW SIGNIFICANCE OF VENTILATION

All indoor work has had an odium cast upon it and the popular impression is that it is injurious to health and longevity. Golf and the outdoor sports are for the few and it is strictly up to the engineer to make the working quarters of all as pleasant and healthful as the outdoors by reproducing all those conditions. We must prepare to house our people for twelve months of work in every year, and make the efficiency of the worker as high in January and July as it is now in May. Ten years of research has done much, but the next ten years must vie with other decades in producing startling revelations that shall add to the sum of our happiness.

## New Home Study Course in Gravity Steam and Water Heating

(*Continued from Page 72*)

The required depth for a given fire pot may be determined as follows:

First: Estimate the rate of combustion by reference to Table B-1-1 and multiply this by area of grate in square feet.

Second: Multiply product obtained under First by the desired firing period in hours and obtain weight of one fuel charge (not including reserve fuel).

Third: Multiply result under Second by 1.2 and obtain total weight of one charge (including 20% reserve for igniting fresh charge).

Fourth: Multiply average area of fire pot in square feet by the weight of fuel per cubic foot. Use 50 lbs. for anthracite and 40 lbs. for bituminous.

Fifth: Divide result Third by result Fourth and obtain the depth of fuel bed in feet for the given fire pot.

#### Work Problem B-1-17

#### FIRING PERIOD

The firing period in hours permitted for a given fire-pot may be estimated as follows:

First: Multiply average area of fire-pot by the weight of fuel per cubic foot.

Second: Multiply result First by depth of fire-pot in feet.

Third: Multiply grate area in square feet by the rate of combustion and the product obtained by 1.2.

Fourth: Divide result Second by result Third and obtain the firing period in hours.

#### Work Problem B-1-18

#### COMBUSTION CHAMBER VOLUME

The combustion chamber volume is the actual volume expressed in cubic inches (or cubic feet) of the space within a boiler in which combustion may occur. If insufficient for the fuel burned combustion is impaired, the gases do not have enough space to unite with the proper amount of oxygen and expand to develop full heat of combustion, with the result that overall operating efficiency is low.

#### Work Problems B-1-19, B-1-20

**Table B-1-1. Average Rates of Combustion for Steam and Water Boilers. (Safe Increase 10%)**

| FURNACE SIZE | SMALL | MEDIUM | LARGE |
|---|---|---|---|
| Grate, square feet | 6 or less | 6-10 | 10 or over |
| Coal per hr. per sq. ft., pounds | 5 | 5.7 | 6.6 |
| Run on one firing with 20% reserve, hours | 8 | 7 | 6 |

# Humidification and Its Cost

## A Comparison of the Saving and Expenditure of Heat by Increasing the Moisture Content in the Air

*By Harold L. Alt*

TIME and again, in both technical magazines and trade literature, the statement or inference is noted that there is an actual cost economy in humidifying air in heated buildings during cold weather. Such a statement presented as a fact does not occur as frequently as the implication, which is even more subtle, leading the reader to draw the wrong conclusion and apparently with the intention of accomplishing this very result.

While the implied statement is more objectionable than the positive assertion, it is also the more difficult to discredit. For who rightly can prove as incorrect that which never has been asserted?

Now humidifying costs money unless it can be accomplished by an existing means which otherwise would still exist but which would not be utilized.

For instance, if a factory is assumed which (in the process of ordinary work) gives off sufficient vapor to humidify the air up to the desirable point, then a condition exists in which humidifying really costs nothing. It is simply a by-product of the manufacturing process. Such conditions might exist in a laundry or other moisture-producing industry.

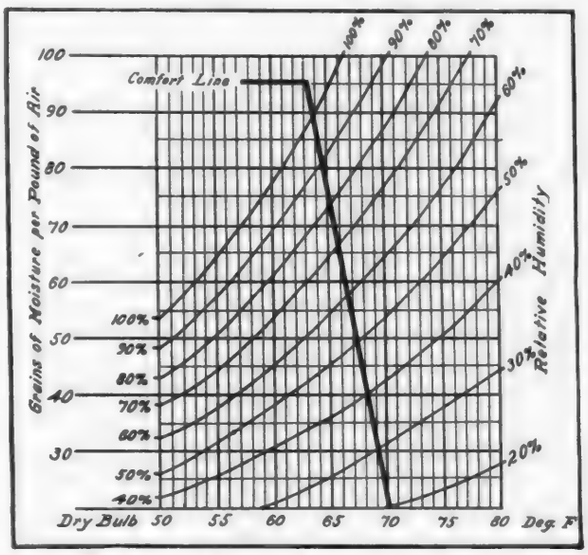


Fig. 1. Simplified Form of "Effective Temperature" Chart

Yet, in such cases no one ever thinks of wanting arguments for more humidity; on the contrary, there is already an over-abundance of dampness, and so the arguments on the dangers and undesirability of cold, dry winter-heat cannot apply to such installations.

On the contrary, the writers generally asssume the home, the office, and the public building as a fertile field to cite for the examples they are seeking. Reference is made to the efforts indulged in by the occupants (such as putting pans of water on the radiator, use of damp towels, and other make-shifts) to remedy this excessive and obnoxious dryness.

### REDUCED TEMPERATURE WITH HUMIDIFYING

Then the subject of reduced temperature with additional humidity giving more comfort than the higher temperature with the normal dryness is usually presented. The coal saving with the reduced temperature is often vaguely referred to and is sometimes actually declared to exist. A little investigation into this subject is not only interesting but also enlightening.

It is proposed to limit this discussion to two typical cases and it will not be difficult, after seeing how these work out, to judge how much truth there is in such talk. The first case to be discussed is the extreme condition occurring when the outside temperature is 0° F. and the inside temperature 70° F., while the second case is for average winter weather when the outside temperature is, say, around 30° F. and the inside 70° F.

Of course, to get a reasonable working basis, some assumptions will have to be made, but it will be endeavored to keep these assumptions as fair and equitable as possible, with the idea of being just and impartial. Still, the assumed conditions must be in line with what is most likely to occur in the cases under consideration and cannot be distorted to extremes in any way. If anything, they must represent average conditions.

### TABLE OF RELATIVE HUMIDITY

Before proceeding to the consideration of Case I it is desirable to set down a little table for the reader's reference, as this will aid in quickly grasping the various facts as they are pointed out. This little table, designated as Table I, is nothing but a schedule showing the number of grains of water vapor per pound of air at various temperatures and percentages of relative humidity.

### CASE I—WITH EXTREME CONDITIONS

If, in Case I, a relative outside humidity of 50% is assumed, then every cubic foot of air entering the house or room by infiltration and becoming heated up to 70° will contain 0.28 grains of moisture. It will also expand so as to amount to somewhat more than one cubic foot. This expansion is easily figured when it is known that at 0° F.

TABLE I. WATER VAPOR IN AIR AT VARIOUS TEMPERATURES AND HUMIDITIES

| Temp Deg Fahr | GRAINS OF MOISTURE PER CUBIC FOOT | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | RELATIVE HUMIDITY IN PER CENT | | | | | | | | | |
| | 100 | 90 | 80 | 70 | 60 | 50 | 40 | 30 | 20 | 10 |
| 75 | 9.356 | 8.420 | 7.485 | 6.549 | 5.614 | 4.678 | 3.742 | 2.807 | 1.871 | 0.936 |
| 72 | 8.508 | 7.657 | 6.806 | 5.956 | 5.105 | 4.254 | 3.403 | 2.552 | 1.702 | 0.851 |
| 70 | 7.980 | 7.182 | 6.384 | 5.586 | 4.788 | 3.990 | 3.192 | 2.394 | 1.596 | 0.798 |
| 67 | 7.241 | 6.517 | 5.793 | 5.069 | 4.345 | 3.620 | 2.896 | 2.172 | 1.448 | 0.724 |
| 65 | 6.782 | 6.104 | 5.426 | 4.747 | 4.069 | 3.391 | 2.713 | 2.035 | 1.356 | 0.678 |
| 60 | 5.744 | 5.170 | 4.595 | 4.021 | 3.446 | 2.872 | 2.298 | 1.723 | 1.149 | 0.574 |
| 50 | 4.076 | 3.668 | 3.261 | 2.853 | 2.446 | 2.038 | 1.630 | 1.223 | 0.815 | 0.408 |
| 40 | 2.849 | 2.564 | 2.279 | 1.994 | 1.709 | 1.424 | 1.140 | 0.855 | 0.570 | 0.285 |
| 30 | 1.958 | 1.762 | 1.566 | 1.372 | 1.175 | 0.979 | 0.783 | 0.587 | 0.392 | 0.196 |
| 20 | 1.321 | 1.189 | 1.057 | 0.925 | 0.793 | 0.660 | 0.528 | 0.396 | 0.264 | 0.132 |
| 10 | 0.873 | 0.786 | 0.698 | 0.611 | 0.524 | 0.436 | 0.349 | 0.262 | 0.175 | 0.087 |
| 0 | 0.564 | 0.508 | 0.451 | 0.395 | 0.338 | 0.282 | 0.226 | 0.169 | 0.113 | 0.056 |

there are 11.58 cu. ft. of air to a pound and at 70° F. there are 13.34 cu. ft. to a pound. So the increase in quantity is 13.34—11.58 or 1.76 cu. ft.; and 1.76/11.58 is 15¼%. Therefore, the 0.28 grains of moisture are now distributed over 1.15¼ cu. ft. of air, giving 0.28/1.15¼, or 0.243 grains per cubic foot at 70° F.

### INCREASE OF HUMIDITY AFTER ENTERING ROOM

As 70° F. air at saturation contains 7.98 grains of moisture per cubic foot, the percentage of relative humidity of air containing 0.243 grains is 0.243/7.98 or 3% plus, assuming that no moisture is picked up in the room. Many factors, however, contribute toward increasing the humidity, such as vapor given off by the skin and in the breath of human beings, drying out of wood, plaster and other objects in the room, vapors from cooking, baths, plants, wet clothing, and so on. Actual experiment seems to indicate that this 3% really increases to 25% to 30%, owing to the moisture absorbed by the air after entering the room.

Admitting, for the sake of argument, that this 30% is the actual condition of the air which has entered a room on a zero day and has been heated to 70° F., the next thing to find out is how much humidity must be added to bring this air to the proper and desirable percentage of relative humidity. For this purpose it is necessary to refer to the "Psychrometric Chart of Effective Temperature Lines" for still air conditions, as developed by the A.S.H. & V.E. Research Laboratory, and to ascertain what "effective temperature" may be assumed as being satisfactory to the majority of people.

### COMFORT LINE OF TEMPERATURE AND HUMIDITY

In connection with the chart above mentioned, the statement is found, "That particular 'effective temperature' at which a maximum number of people feel comfortable is 64° 'effective temperature' and is called the *comfort line.* While at rest in still air, 97% of all people are comfortable at this temperature." Note that the "temperature" mentioned is the "effective" and not the dry-bulb *temperature.*

Again going back to the chart, it is found that 64° "*effective* temperature" runs from 64° F. and 100% humidity to 71½° with no moisture (absolutely dry air). On the portion of the chart reproduced here (Fig. 1) temperatures down to 20° only are shown. From this it can be seen that the comfortable temperature at, say, 30% relative humidity would be 69° F., but, if the humidity is raised up to a desirable amount (which is generally regarded as around 60%), the temperature could be dropped to 66½° F., or 2½° F. less than before with the 30% relative humidity condition. Not a very big saving, surely.

### TYPICAL ROOM HEAT LOSS

Applying this to a concrete case, suppose a room, (Fig. 2), 9 ft. high and 12 ft. wide by 13 ft. long with the 12 ft. wall an outside wall, facing south, and having two windows 3 ft. by 5 ft. All other walls, ceiling and floor are warm. The heat losses for such a room on a zero day and with good construction would amount to the following:—

Gross wall, 12 x 9 ..... 108 sq. ft.
Net wall, 108—(3 x 5 x 2) ..... 78 sq. ft.

| | B.T.U. |
|---|---|
| Wall loss, 78 x 20 B.T.U. | 1560 |
| Glass, 3 x 5 x 2 ..... 30 sq. ft. | |
| Glass loss, 30 x 70 | 2100 |
| One air change per hour, 13 x 12 x 9 x 1.44 | 2021 |
| Total | 5681 |

For 69° F. the heat loss per hour would be 69/70 of 5681 B.T.U., or 5600 B.T.U.

For 66½° F. the heat loss per hour would be 66½/70 of 5681 B.T.U., or 5397 B.T.U.

The difference between the two above amounts is 203 B.T.U. saving in heat in the room under consideration for a reduction of 2½° in temperature.

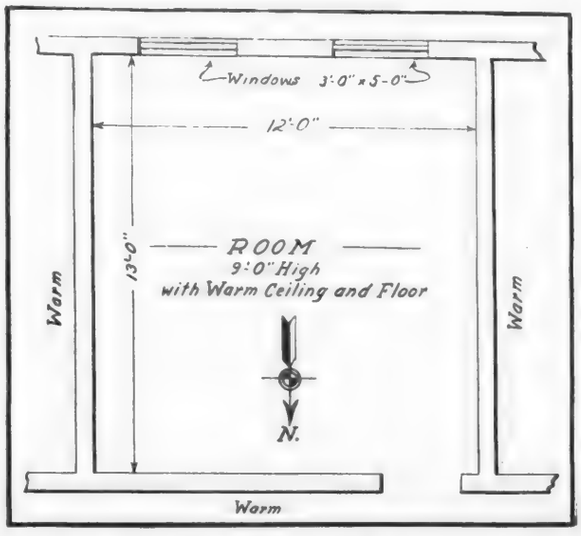


**Fig. 2. Typical Room Used in Calculations**

### ADDITION FOR HUMIDIFYING

But to make this reduction in temperature possible and to produce the same heating sensation of comfort the humidity must be raised from 30% to 60%. This means a certain vaporization of water over and above that naturally due to ordinary living conditions. The number of cubic feet of air per hour to be humidified has already been determined to be 1404 cu. ft.

Since the air at 70° F. and 100% humidity contains 7.98 grains of moisture per cubic foot (see Table I), at 69° F. it will contain about 7.74 grains, and with 60% relative humidity it will contain 60% of 7.74 grains, or 4.64 grains; at 30% relative humidity it will contain 30% of 7.74 grains, or 2.32 grains (just half as much). Consequently, the 2.32 grains must be added to each and every one of the 1404 cu. ft. every hour or 2.32 x 1404, which is 3257 grains. Reducing this to pounds of water, 3257/7000 is 0.47 lbs. As it takes about 1000 B.T.U. to evaporate 1 lb. of water and to heat it up to room temperature, the B.T.U. required will be 0.47 x 1000, or 470 B.T.U.

### NET LOSS FOR HUMIDIFYING

If it is required to add 470 B.T.U. to evaporate the water necessary for humidifying and only 203 B.T.U. can be saved by the reduction in temperature, it is easy to see that there is a net loss of

470 — 203, or 267 B.T.U.

Therefore, it is proved that for zero conditions outside there not only is no saving possible in humidifying, but there is actually a loss.

### CASE II—WITH MODERATE CONDITIONS

Let us now take up the conditions obtaining in Case II where the outside temperature is assumed as being 30° F., and see if any better results can be secured.

It is only fair to assume that, in Case II, with 30° F. outside temperature, the relative humidity in the room with artificial humidification would be somewhat higher—say 40%. Going back to the Comfort Line again it will be seen that it will require a temperature of 68½° at 40% relative humidity to give equal comfort, while if the temperature is made 66½° the comfort will be the same if the humidity is raised to 60%, the same as in Case I.

### HEAT LOSSES FOR ROOM

The heat loss for the room at 68½° F. will then be for the net wall:

| | B.T.U. |
|---|---|
| 38.5/70 of 1560 B.T.U. | 858 |
| and for the net glass. | |
| 38.5/70 of 2100 B.T.U. | 1155 |
| while for air change. | |
| 38.5/40 x 0.770 x 1404 | 1039 |
| Total for room | 3052 |

With the temperature reduced to 66½° F. the loss will be:

| | B.T.U. |
|---|---|
| 36.5/70 x 1560 | 813 |
| 36.5/70 x 2100 | 1095 |
| 36.5/40 x 0.770 | 986 |
| Total for room | 2894 |

In this instance the saving in heat will be 3052 B.T.U.—2894 B.T.U., or 158 B.T.U.

### HEAT FOR HUMIDIFYING

But, again, to make this saving possible it is necessary to evaporate enough water to raise the humidity from 40% to 60%, which is computed as follows:—

Air at 68½° saturated will contain about 7.62 grains of moisture; at 60% relative humidity it will necessarily have 60% of 7.62 grains, or 4.57 grains.

At 40% relative humidity it will contain 40% of 7.62 grains, or 3.05 grains.

The difference which must be added is 1.52 grains per cubic foot, or 1404 x 1.52, or 2134 grains which, divided by 7000, equals 0.305 lbs. of water.

As each pound of water requires about 1000 B.T.U. to evaporate it, the B.T.U. required for humidifying will be 0.305 x 1000, or 305 B.T.U.

This shows that, where a saving of 158 B.T.U. can be made on the heat, an expenditure of 305 B.T.U. must be employed to humidify, leaving a net loss of 147 B.T.U.

These figures prove that in all ordinary cases neither normal nor extreme conditions produce any net saving on the heating end by humidifying. Other advantages may, and do, amply justify humidifying, even rendering it profitable, but the statement that a saving in heat is effected purely from a heating standpoint has nothing to substantiate it under ordinary conditions.

## Pipecraft

(*Continued From Page* 68)

around the pipe. In roof fills, if possible, use double covering. After the covering is placed on the pipe the galvanized-iron covers are placed over the line, with sufficient clearance to allow for expansion. The covers are cemented down along the edges to hold them in place. After this has thoroughly hardened, the whole is covered with concrete fill.

If the concrete contains cinders the pipe and fittings should be painted with two heavy coats of asphaltum before covering, to prevent the sulphur fumes from the cinders from disintegrating the metal.

*The next section of "Pipecraft" will take up the subject of mains, and the connecting of boilers and other apparatus.*

The Heating and Ventilating Magazine

A Monthly Journal of Engineering Progress

*MEMBER*
*National Publishers' Association*
*Associated Business Papers, Inc.*
*Audit Bureau of Circulations*
*National Trade Extension Bureau*
*American Oil Burner Association*

VOL. 24 June, 1927 No. 6

Published Monthly at New York, N. Y., by the
HEATING AND VENTILATING MAGAZINE COMPANY
Executive and Editorial Offices, 1123 Broadway, New York

A. S. ARMAGNAC . . . . . President
GUSTAVE PETERSEN . . . . . Treasurer

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| Subscription | $2.00 per year |
| Canada | 2.50 per year |
| Foreign Countries | 3.00 per year |
| Back Numbers | 50 cents each |

MOST of us are so near the firing line that many of the movements which seem so important at the moment are eclipsed and, perhaps, forgotten in the stress of new and more urgent activities. When we are obliged to look at things from a detached point of view, as has been this writer's experience recently, we see them in a different, and often a clearer, light. So it is with respect to events in the heating and ventilating field. While the mind turns easily to the almost revolutionary changes in the practice of the art, brought about by the advent of such appliances as the unit heater, dry air filter, oil burner, gas heater and copper radiator, it is not so much these which loom large in a "detached perspective" as it is the numerous movements in the industry, begun with such high resolve and enthusiasm which, for various reasons, still await the finishing touch. It seems that the heating industry has had more than its share of unfinished projects and the question arises whether the difficulty is not one of methods, rather than one of men.

To take just two of the subjects which long have agitated the industry, namely, boiler ratings and radiation estimating, the anomalous situation exists to-day that while these problems are essentially within the province of the engineer, the most effective progress toward their solution has been made by the commercial branch of the industry. Now, why is this? It is not because there is any lack of initiative on the part of the engineer. As a matter of fact, it has been the engineer members of commercial organizations who actually have been doing the work and who are responsible largely for the results achieved. The answer, we are convinced, lies mainly in the methods pursued; it all comes down to a very simple matter of direct interest on the part of practical men versus indirect interest on the part of men who are practical enough, but who are bound and limited, nevertheless, by ethical standards which prescribe their course of procedure and their means for prosecuting the work.

In other words, the commercial interests see something that means dollars and cents to them and they proceed to spend money to get it. They give their committeemen a free hand and stand prepared to "pay the piper" for expenses incurred in reaching a given goal. The cost is looked upon as an investment which will yield returns in coin of the realm. Engineering bodies, on the other hand, once their committees are named, leave the completion of the project very much an individual affair, usually of the chairman, and its progress or lack of progress is dependent, as a rule, on the private means and interest of that individual. We are aware of the steps which have been taken to remedy this situation, but the fact remains that engineering committees face a handicap in the matter of expense that is not imposed upon committees representing commercial organizations.

These thoughts, suggested by a "detached perspective," lead naturally to the further thought that, such being the conditions, why not recognize them frankly and develop a program of co-operation between the two branches of the industry whereby the desired ends or a compromise will be reached, thus avoiding the spectacle of more than one "standard" method of figuring radiation, rating boilers and of calculating other items which make up the fundamentals of good heating practice.

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WHILE the thoughts just expressed are given first place in our "detached perspective," the very real and substantial achievements of the industry are not overlooked. Nor is the immensely significant step, just taken by the A.S.H. & V.E. Research Laboratory, in enlarging its scope to conduct tests and investigations for other organizations.

We predict that the enlarged program to be carried out at the Research Laboratory will be more than justified by the event. It may even be the means of furnishing that *liaison* between the engineering and commercial branches of the industry which is so essential.

## National District Heating Association

# Past Year Sees Record Growth in Central Station Heating

### The By-Product Generation of Electricity, the Study of Demands Primarily as They Affect Future Rate Structures, Metering and Utilization, and the Proper Insulation of Underground Piping Occupy Center of Stage at Annual Convention

TRUE to form, the eighteenth annual convention of the National District Heating Association, held May 17-20, at West Baden Springs, Ind., broke all attendance records, with a registration of 151 members and guests. The meeting also reached a new peak in the interest and value of the papers and discussions presented. Outstanding features were the report of the Distribution Committee, dealing with economical thicknesses of insulation for underground piping, and the reports of the Rates and Regulations Committee, Heat Utilization Committee, and Meters and Accessories Committee, the latter covering matters pertaining to a demand rate for district heating.

As in the more recent past, there was no exhibit space provided as such for the convention, but numerous manufacturers had representatives on hand, with samples of their products and descriptive literature.

## Opening Session, May 17

President J. E. Seiter called the convention to order in the convention hall of the West Baden Springs Hotel, Tuesday afternoon, May 17. In his address he stated that the past year has been notable for the recognition given to the district heating industry by many of the large utility companies and technical societies.

"Several companies," declared Mr. Seiter, "which have been striving for years to secure appropriations for extensions and new plants, finally have succeeded in obtaining approval of their plans." That utility men are seeking additional information on the central station heating business, he pointed out, is evidenced by invitations to address such organizations as the Edison Companies and Nela. He also mentioned the requests which have come from the A.S.H. & V.E. not only for speakers but for a committee to prepare a chapter on district heating for the Guide. The A.S.M.E. has asked for a committee from the association to prepare a code for power piping. A tie-in has been established between the Prime Movers Committee of Nela and the N.D.H.A. to bring before the utility men the subject of by-product generation of electricity.

In addition he mentioned the recognition of the association by the Building Owners and Managers Association. "Co-operation between these two organizations," said Mr. Seiter, "which started last year, has continued throughout this year with a series of illustrated talks by our members before their local chapters."

**Charles A. Gillham**

President of the National District Heating Association.

Mr. Gillham is vice-president of the New York Steam Corp., vice-president of the U. S. Mineral Wool Co., president of the Insulating Products Co., and vice-president of the Bellum Supply Co.

Prior to his connection with the New York Steam Corp., he was with the Central Station Engineering Co. and American District Steam Co., both firms being designers and builders of central station heating systems.

Mr. Gillham also formerly managed gas, electric and heating properties in the middle west, having been operating, designing or building utility properties for over thirty years.

#### ORGANIZATION OF MANUFACTURERS' DIVISION

Recognition of the changing trend of the industry has been shown by the manufacturers in the organization of a special unit, known as the Manufacturers' Division, to assist in the further development of district heating. This division has co-operated most cordially with the association through the Development Committee.

"This general appreciation of the commercial value and distinct advantages of district heating," continued Mr. Seiter, "is most gratifying, and this year may well be termed a year of recognition."

#### PROGRAM OF ENLARGED ACTIVITIES

Many suggestions offered by Mr. Seiter, in which the association should enlarge its activities, are the development of the association's Bulletin, republication of the Handbook, and certain committee reports, such as those on heat utilization, a guide on rates and rate structures, and a text book on the fundamentals of district heating.

President Seiter mentioned three major projects which would be considered at the convention: (1) The by-product generation of electricity, (2) the study of demands primarily as they affect future rate structures, metering and utilization, and (3) the proper insulation of underground piping.

Secretary D. L. Gaskill reported receipts for the year of $13,453, and expenses of $8754, leaving a balance on hand of $4699. The membership of the association, he reported, is now made up of 110 class A members, 105 class B members, 34 class C members, 40 associate members, 9 class D members, and 2 honorary members, bringing the total membership to 300. This is a gain for the year of 34 members.

Evidence of the benefit derived by the association from the formation of the Manufacturers' Division was given in the statement that it has not only brought about an increase in membership but also an increased interest on

the part of the manufacturers. According to the plans of the division nothing will be done to encourage the establishment of heating plants in territory where they will not pay. "As a result," said Mr. Gaskill, "we may expect from now on that district heating will take a distinct place in the utility field, and that the business will be classified among the utilities as one of the profitable branches of that great field."

The Educational Committee, he reported, has prepared a number of additional sheets for the association's Handbook. In addition, advertisers who placed sheets in the original edition are now recasting and changing their sheets, so that before the end of 1927 present holders of the Handbook may expect to receive additional sheets that will bring the book up to date in every particular. Mr. Gaskill stated that the sale of the association's pamphlets on "Office Ventilation" and "Principles and Methods of Heat Saving" had been enormous. No less than 72,000 copies of "Office Ventilation" have been sold, and 3100 copies of "Principles and Methods of Heat Saving." He reported an increased demand for bound volumes of the Proceedings.

In reporting for the Executive Committee, Mr. Gaskill gave details of the Executive Committee's fall meeting, held last October in Detroit. He also mentioned that at the meeting of this committee, immediately preceding the opening of the convention, more new members were passed on than at any previous meeting in the history of the association.

For the Membership Committee, H. C. Kimbrough, chairman, stated that the activities of his committee were covered in the report of Secretary-Treasurer Gaskill.

For the Educational Committee, J. H. Walker reported that 25 new sheets for the Handbook had been compiled, which, he stated, brought the volume "abreast of the times." These sheets are now in the hands of the printer, and will be distributed by next fall. Arrangements have also been made whereby additional covers similar to that of the Handbook may be secured through the secretary's office.

## Report of Operating Statistics Committee

For the Operating Statistics Committee, J. C. Butler, chairman, presented the compilation for the year, corresponding to the data of previous years. Thirty-eight companies were listed in the report, with an annual sale of steam slightly under twenty billions of pounds, representing 75% of the district heating business of this country. The total customers for 1926 was 12,202, a growth of nearly 2000 over 1925. The average number of customers per company was 321. There were 1632 residential customers and 8570 business customers. Steam produced or purchased by 33 companies, expressed in 1000 lbs., was 14,584,471. The connected load, equivalent direct radiation, reported by 27 companies was 30,641,000 sq. ft. The average connected load was 1,135,000 sq. ft. Steam required per square foot of radiation per year averaged 555 lbs. As was the case last year, the heating season, reported in average length, in days, amounted to 254, while the average temperature was 41.1° F. Apparently the committee did not find it possible to adopt a suggestion made last year that the load be expressed in degree days. The income per 1000 lbs. of steam reported by 33 companies ranged from 48c to $1.105 or an average of 91.1c.

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For members of the Nominating Committee President Seiter appointed E. L. Wilder, chairman, F. B. Orr and Henry Meyer. In the Manufacturers' Round Table, which concluded the session, Mr. Ogden, of C. E. Squiers Company, Cleveland, O., described a single-seated, metal-diaphragm, pressure-reducing valve, capable of reducing from 500 lbs. to 1 lb. in a single step. The seat and disc are made of phosphor bronze or of monel metal, as desired.

## Evening Session, May 17

In conformity with the practice instituted last year, an evening session was held. First Vice-President Charles A. Gillham presided and called upon F. B. Orr, chairman of the Heating Research Committee for the report of that committee.

## Report of Heating Research Committee

In presenting this report, F. B. Orr, chairman, stated that he had hoped to include considerable operating data to substantiate or refute the general conclusion arrived at in the committee's report of 1926, dealing with a subject of by-product electric generation. He stated, however, that preliminary data seemed to justify the decision of a number of important companies to venture into this plan, and he quoted one report covering the first two months' operation of a 5000 KW. unit.

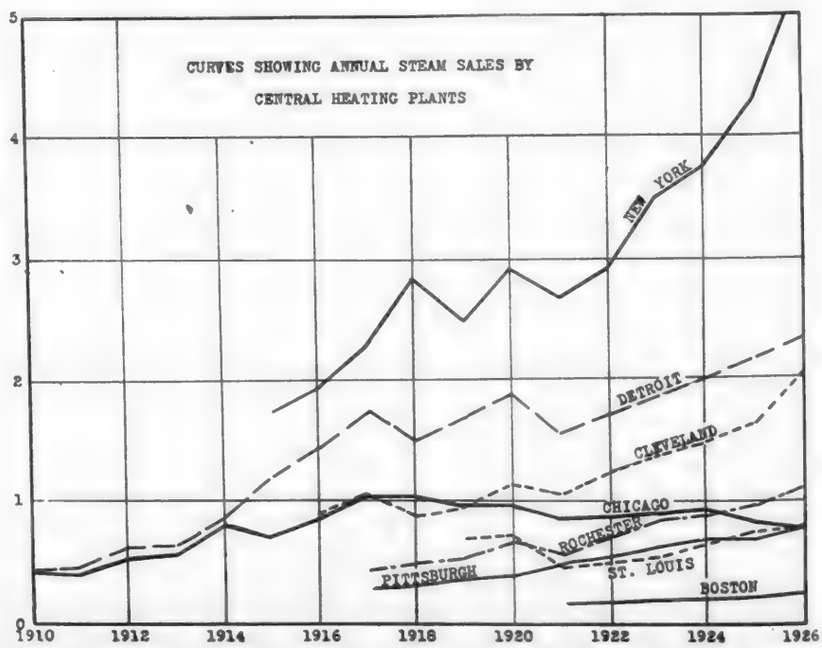
An important section of the report was devoted to competitive forms of heating, including natural and manufactured gas, oil, electricity and coal. This section was compiled by David Caleb and included data tending to the conclusion that gas heating is becoming a success and that an enormous field exists for oil heating.

He emphasized the need of introducing economies in the field of steam heat utilization. Preliminary investigation indicated and experience has proved that natural gas or oil cannot compete with the cheaper fuels unless economies are realized in their use. This fact has become so generally known that temperature regulation and insulation which, it was stated, have come to be recognized as a part of every heating job with results that costs are approaching or even exceeding in economy the comparable cost of coal and central station service.

There has been no general use of insulation, it was stated, with the effect that in central station heating we are still using wasteful methods, even with newer and improved systems.

The interesting statement was made that the present capacity of the gas lines supplying natural gas to Kansas City is 150 million cu. ft. per day. This gas is used largely for domestic purposes, but there are approximately 1700 homes heated with gas and some industrial use of this fuel.

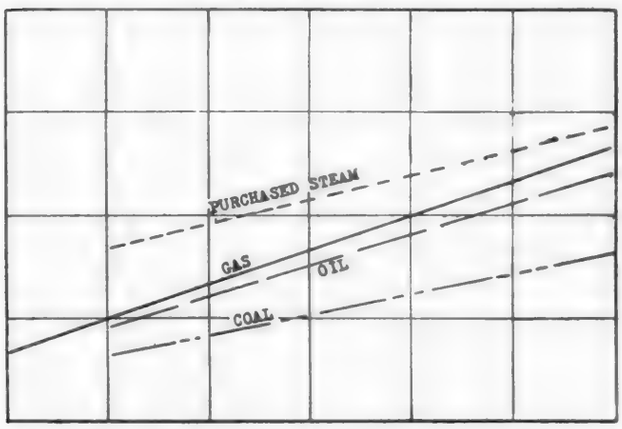
Mr. Caleb made the statement that it




**How the Principal District Heating Companies Have Grown Since 1910**

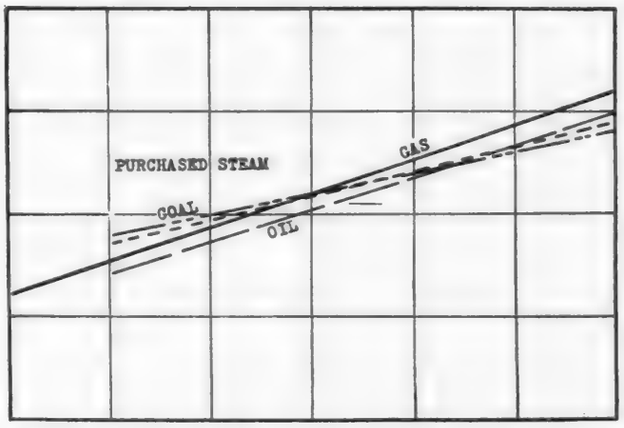
COMPARATIVE COSTS OF VARIOUS FUELS AND PURCHASED STEAM—TO PRODUCE EQUIVALENT COSTS PER 1,000,000 B.T.U. UTILIZED IN A BUILDING WITH 5000 SQ. FT. OF RADIATION

**Actual Cost of Heat Corrected for Differences in Plant Efficiency**




| | | | | | | |
|---|---|---|---|---|---|---|
| $2.00 | 3.00 | 4.00 | 5.00 | 6.00 | 7.00 | 8.00 |
| Coal per ton | | | | | | |
| $1.00 | 1.50 | 2.00 | 2.50 | 3.00 | 3.50 | 4.00 |
| Oil per bbl. | | | | | | |
| $.20 | .30 | .40 | .50 | .60 | .70 | .80 |
| Natural gas per 1,000 cu. ft. | | | | | | |
| $.60 | .70 | 80 | .90 | 1.00 | 1.10 | 1.20 |
| Purchased steam per 1,000 lbs. | | | | | | |

**Including Estimated Fixed Charges and Labor**




| | | | | | | |
|---|---|---|---|---|---|---|
| $2.00 | 3.00 | 4.00 | 5.00 | 6.00 | 7.00 | 8.00 |
| Coal per ton | | | | | | |
| $1.00 | 1.50 | 2.00 | 2.50 | 3.00 | 3.50 | 4.00 |
| Oil per bbl. | | | | | | |
| $.20 | .30 | .40 | .50 | 60 | .70 | .80 |
| Natural gas per 1,000 cu. ft. | | | | | | |
| $.60 | .70 | 80 | .90 | 1.00 | 1.10 | 1.20 |
| Purchased steam per 1,000 lbs. | | | | | | |

is now proposed to lay a pipe line from the Panhandle gas-oil field to supply gas to Denver, Kansas City and the intervening districts for general heating and industrial purposes. The Kansas City part of this line would be about 450 miles long, delivering 110 million cu. ft. of gas per day and would cost 25 million dollars. The lower limit of sale price for gas supplied for industrial purposes would approximate 25c per 1000 cu. ft. This price is not sufficiently low to supplant other fuels as now used by the public utilities, but it would be so much lower than present higher-priced fuels as used by individual customers that serious inroads on present business must be expected. In addition, Mr. Caleb pointed out that improvements in the manufacture of large pipe from steel plate by automatic welding machines will probably so reduce the cost of pipe lines that this lower limit of 25c per 1000 cu. ft. of gas can be reduced even when the gas is delivered over very long lines.

Engineering surveys, he said, are now being made in at least two large cities with a view of delivering fuel oil through similar distribution systems.

In order to bring out the results that are actually obtained from gas as fuel, figures for the past year's operation of a two-story frame stucco residence were submitted, showing a heating and cooking net bill of $159.86. This compares with a cost of $150.00 for semi-anthracite coal as used in the same plant in previous years.

The report contained a reproduction of the fuel analysis by Harold L. Alt, published in THE HEATING AND VENTILATING MAGAZINE for January, 1927.

Another section called attention to the encouraging growth in the heating industry as indicated by the new boiler plants built in Detroit, Rochester and New York City, while another plant is under construction in Philadelphia and one is planned for Akron, O. Rochester also is about to build a second station to serve the industrial load in that city. Perhaps the most phenomenal growth, stated the report, is taking place in New York City, as indicated in the accompanying chart which was compiled from data recently received.

At the close of his report Mr. Orr suggested that the Heating Research Committee study steam accumulators and mercury vapor boilers.

Chairman Gillham introduced C. W. Organ, general superintendent, Electric Department, Illinois Power Company, Springfield, Ill., who delivered an address on "Combined Electric and Heating Plants Operated as Heating Stations with Electricity as a By-Product." Mr. Organ gave a description of the design and operation of such plants by his company, which have been operating under the plan described since 1925. This address was well received and numerous questions were asked of Mr. Organ, all of which he answered clearly and concisely.

John W. Meyer, chairman of the Development Committee, submitted the report of his committee. This report covered the combined activities of the association and the Manufacturers' Division.

In reporting for the Manufacturers' Division, H. R. Wetnerell told of the meeting of the Division on the preceding day.

(As this was a closed meeting, no detailed report was given out).

## Morning Session, May 18

Vice-President C. H. Day, who presided, introduced Professor J. D. Hoffman of Purdue University, who presented a paper on "Design for a New Underground Heating and Power Intercommunicating System for Purdue University." (This paper will appear in a later issue of THE HEATING AND VENTILATING MAGAZINE.)

In the discussion which followed, N. W. Calvert asked Professor Hoffman if gravity ventilation only was used for the tunnel, and if so, would it not be well to install louvers in the ventilating ducts in order to maintain higher temperatures and reduce the heat loss. He also asked whether any trouble was anticipated with the electric cables in a heating tunnel. Professor Hoffman explained that louvers would possibly be installed in the ducts later, and that the possibility of trouble with cables was being minimized by installing the more important ones near the floor in the cooler areas.

Professor Hoffman was asked to what he attributed the low temperatures in the tunnel and stated that he believed the insulation used, sectional magnesia 1-in. thick, was more efficient than had been anticipated.

In reply to another question Professor Hoffman explained that the sidewalk top

used in the tunnel construction added very little to its cost.

Chairman Day announced that the next four papers had so much of common interest that discussion should be postponed until after the last had been read, and called upon W. W. Stevenson, chairman of the Distribution Committee for the report of that committee.

## Report of Distribution Committee

"Insulation and Waterproofing Features of Underground Steam Piping" formed an important part of the report of the Distribution Committee. Recent experiences of member companies with steam distribution systems were also described, notably those connected with steam main construction in Rochester, N. Y., the technique of electric welding, as practiced by the American District Steam Company, the growth of district heating and suggestions for a survey of territory preliminary to the installation of steam piping.

Supplementary sections of the report were devoted to "The Concentric Piping System of Steam Transmission," by J. E. Woodwell and Claud R. Erickson; and "Economical Thickness of Insulation for Underground Distribution Systems," by R. H. Heilman, senior fellow, University of Pittsburgh, Mellon Institute of Industrial Research.

The data on condensation in bare pipe buried underground were supplementary to the tests made a few years ago by the late Prof. John R. Allen. The test result as indicated in the accompanying chart is that obtained with a standard 3 in. steel pipe buried 5 ft. 3¼ in. to the center of the pipe in "gravel soil" at the University of Michigan. The pipe was uninsulated, 112 ft. long and was installed in the shape of a U. It had been in the ground for five years previous to this test.

Comparative tests of underground pipe lines were based on the use of channel tile multicel tile and concrete box construction, stated the report, representing the three methods now in general use. In one tabulation using a 6 in. steam line, the total relative cost, based on 100% for channel tile, came to 103.1% for multicel tile and 117.7% for concrete box. Using a 12 in. steam line, the total relative cost, with channel tile figured at 100%, amounted to 106.6% for multicel tile, and 118.7% for concrete box. Although the highest in cost, the concrete duct, it was pointed out, is the strongest construction of the three types and if properly installed is least likely to be affected by earth movements and is more nearly water proof. To offset these advantages, however, it takes much longer to construct and requires the obstruction of streets for a longer time.

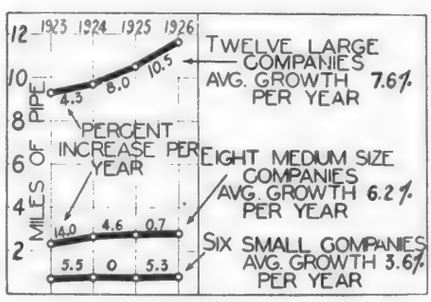
The steam main construction in Rochester, described in the report, told of the use of welding of the steam mains in that city and the statement was made that in the past two years the corporation has installed over 30,000 ft. of pipe in sizes from 20 in. down, equivalent to over 20 miles of 4 in. pipe, all of which was welded. Only two leaks have developed since the lines have been in service and these leaks were in service connections made in manholes after the manholes were built and where insufficient clearance existed to allow the operator a fair chance to work.

Arc welding was used almost entirely. The high-pressure lines consist of extra-heavy black steel pipe with electric cast-steel expansion joints and similar gate valves welded solidly in the line. The low-pressure line consists of full-weight black steel pipe, with flanged cast-iron expansion joints and similar gate valves. In this line the pipe is welded from manhole to manhole, but gaskets, of course, are used in the flanged connections to the cast-iron fittings.

E. R. Benedict, of the American District Steam Company, furnished a résumé of "The Technique of Electric Welding."

Encouraging facts were presented in connection with the growth of district heating. A method of procedure for making a field survey preliminary to the installation of steam piping was based on that used by the Detroit Edison Company and was characterized as typical of modern American practice.

Much interest centered in the description of the concentric piping system of steam transmission described by J. E. Woodwell and Claud R. Erickson. The installation which formed the basis of the report was that installed in Lansing, Mich., in 1923. In the construction of this system crushed stone and drained tiles were first laid in the bottom of the trench where soil conditions made this necessary. A 4 in. concrete base was then laid. Recesses were made



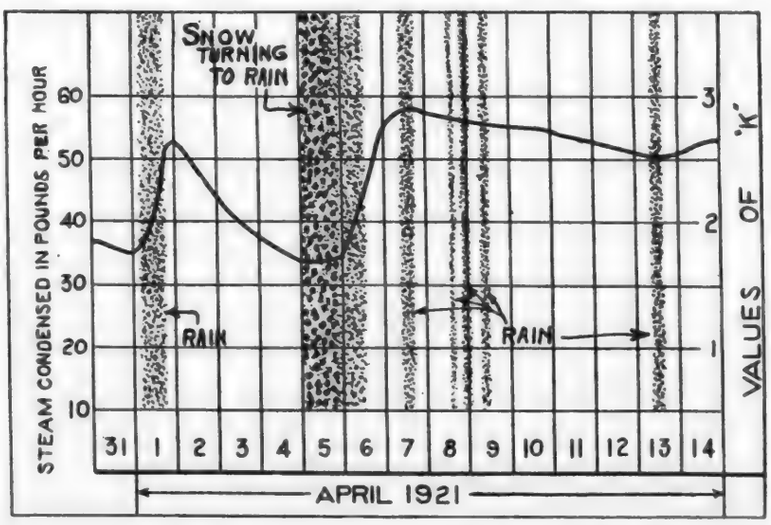

**Increase in Distribution Piping Installed by 26 Typical American District Heating Companies**

(Grouping of companies is strictly on basis of miles of pipe in use.)

in the concrete base to receive the steel conduit, enclosing the piping. Adjustable roller supports were placed at 12 ft. intervals.

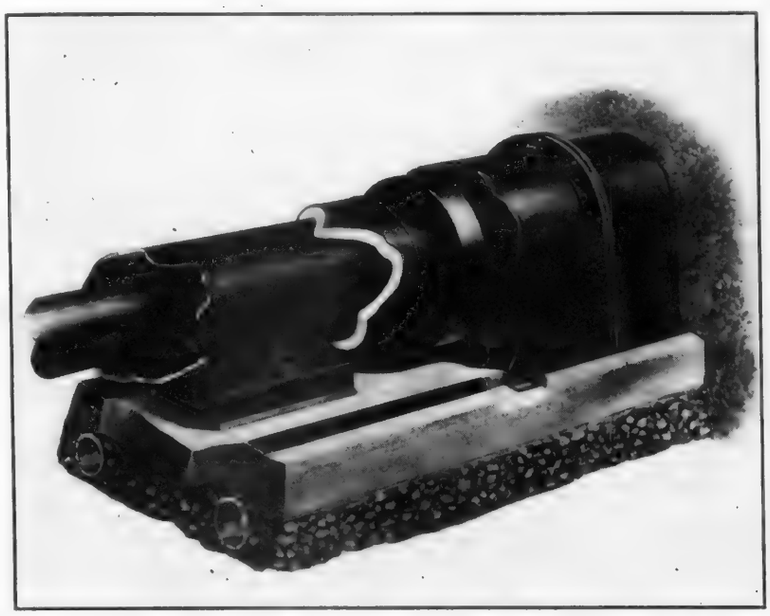
The inside pipe designed to carry steam at 175 lbs. pressure, was installed at the same time as the outer low-pressure main which was designed to operate at not more than 25 lbs. pressure. The inner pipe was supported by alignment guides in the exterior pipe. Line couplings were used to join the lengths of the inner pipe. They were made up before the flanged joints of the outer pipe were bolted together. The outside pipe was then covered with a standard thickness 85% magnesia.

Over the installation was wrapped asbestos roofing for water proofing, fastened with copper wire and the whole was enclosed in a steel conduit consisting of U-shaped 10 ft. sections, joined by angle-iron flanges, one leg of which was riveted to the conduit. Although the cost of construction of the concentric system was higher than that of other types, the report states that the added expense was more than justified by the reduction of heat losses. The low pressure steam becomes moderately




**Effect of Rain and Snow on Condensation of Steam in 3-In. Steam Line Buried in 5 Ft. of Gravel Soil**

(This test made at the University of Michigan in 1921, by Charles A. Burton.)



**Arrangement of High-Pressure Main Inside of Low-Pressure Main in Concentric Piping System**

superheated throughout the length of this system due to transfer of heat from the high-pressure pipe.

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In connection with the Distribution Committee's report, C. R. Erickson, Lansing, Mich., read a paper on the "Concentric Piping System of Steam Distribution."

R. H. Heilman, of the Mellon Institute, read a paper on "Economical Thickness of Insulation for Underground Distribution Systems," and L. B. McMillan, chief engineer, Johns-Manville Corporation, presented a paper on "Selection of Insulation for Steam Distribution Systems."

These papers were all well received and created lively and lengthy discussions. N. W. Calvert pointed out the desirability of getting comparative costs on a basis of actual costs, if possible, rather than by estimates; also that tests made on bare pipe underground were hardly representative of conditions existing with insulated pipe in conduit installed under paved streets. He also emphasized the fact that cost of material and insulating efficiency were not the only factors to be considered in determining the cheapest and best material to be used, as one also must consider waste due to breakage, labor risk of injury in handling certain materials, and similar factors. In the curves showing economical thickness of covering to be used, no consideration seems to have been taken of the cost of enlarging conduit to accommodate greater thickness of covering. He stated that investigations in Detroit had shown that it was economical to add ½-in. covering which could be accommodated without changing the dimensions of the conduit, but it would not be economical to enlarge the conduit to install a greater thickness.

In discussion of Mr. Erickson's paper, Mr. Calvert asked if any study had been made of the economic value of the concentric system of piping, that is to determine whether this system is more or less expensive than the construction of two separate mains. Mr. Erickson did not have this information at hand and was unable to reply definitely but said he believed that this system was as cheap to install as separate mains.

Professor Hoffman asked Mr. Erickson if the inner pipe was welded, and, if not, would the fittings increase the friction losses, to which Mr. Erickson replied that they had at present no formulae available for determining exactly what these losses should be, but that where line couplings were used for making the joints, there seemed to be no appreciable effect on the friction loss.

Mr. Van Dusen, of U. S. Bureau of Standards, was called upon for discussion, and bore out the statement of Mr. Heilman and Mr. McMillan that neither the ground nor an air space can be relied on to any great extent as an insulating medium.

This series of papers was probably the cause of more thorough and interesting discussion than has been given on any one subject in years.

NEW OFFICERS

At this time the chairman called for the report of the Nominating Committee, whose ticket was unanimously elected as follows:

President, Charles A. Gillham, New York Steam Corporation, New York. First vice-president, C. H. Day, Cleveland Electric Illuminating Company, Cleveland, O. Second vice-president, John W. Meyer, Philadelphia Electric Company, Philadelphia, Pa. Third vice-president, J. C. Butler, Illinois Maintenance Company, Chicago, Ill. Secretary-treasurer, D. L. Gaskill, Greenville, Ohio. Members of executive committee, W. W. Stevenson, Pittsburgh, Pa., N. W. Calvert, Detroit, Mich.

## Morning Session, May 19

The reports for this session consisted of the Rates and Regulations Committee, Heat Utilization Committee and Meters and Accessories Committee in so far as the latter two reports pertained to demand studies. John W. Meyer, L. S. Smith, and C. H. Day, chairmen of these committees respectively, submitted these reports.

## Report of Committee on Rates and Regulations

Based on the belief that a system of rates which considers the item of load factors will do much to stabilize the industry, the Committee on Rates and Regulations, John W. Meyer, chairman, confined its report to a consideration of demand rate structures and related matters. The physical methods of measurement, it was stated, are now being given careful consideration by the Meters and Accessories Committee.

A rate structure, it was pointed out, which considers variations in load factors of individual installations involves two items:

(1) Size of the demand and (2), the amount of condensation.

The methods used in practice to determine the demand for billing purposes are:

1. Measuring the demand.
2. Assessing the demand.

The report went into these items in detail, the conclusion being reached that:

1. A rate structure should be based, first, on the size of the demand and, second, on the amount of condensation.
2. The maximum demand may be measured, either at the point of delivery or at the point of discharge, with a very high degree of efficiency.
3. The radiation may be taken as a measurement of the demand.
4. The measured demand might be applied to wholesale customers; and the measured demand or the radiation or assessed demand, to retail customers.
5. The application of the demand system automatically adjusts the rate to changes in load factor. In a properly-designed rate structure, this adjustment is commensurate with the costs.
6. The demand system of charges protects the investment where changes in demand and consumption occur, as between years, due to variation in temperature or from other causes.
7. The demand system of charges makes possible securing of business not now obtainable under the present or block system of charges.

The report concluded with an endorsement of the regulations of the Rates and Regulations Committee of 1922 with some modifications, notably that the demand charge be based on the highest demand during the year until superseded by a higher demand; also that a

radiation charge be made based on the installed radiation or a percentage thereof. Another modification was that a condensation charge should be based upon the number of 1000 lbs. of steam used per month.

An appendix to this report, by David T. Caleb, presented "An Explanation and Discussion of a Radiation Charge Considered as a Demand Charge as Applied by a District Heating System." Another appendix by Mr. Caleb was devoted to "A Fixed Orifice as a Means of Limiting Heating Customer's Steam Demand." Mr. Caleb urged that an investigation be carried on along this line and he gave some data indicating the possibilities of this method.

## Report of Heat Utilization Committee

Several matters which were not included within the scope of previous reports were undertaken by the Heat Utilization Committee. The committee work was grouped under separate divisions, one devoted to the furthering of the association's "Heat Use Booklet" and the promotion of heat use talks before local groups of building owners and managers and others. The committee prepared twelve illustrated copies of these talks, together with four complete sets of slides and made successful arrangements with local speakers in ten cities to give these talks. Other work undertaken by the committee was:

The gathering of information concerning the steam service work with customers, with special reference to establishing and maintaining good will for the district heating company and in selling the ideas of heat saving and steam use to the companies, customers and prospects.

Possible effects of various proposed steam demand rates on the recommendation and methods of heat saving.

Data regarding peak-load periods of individual customers and complete district steam systems for several cities.

Many of the various possible uses for district steam service, particularly in process work.

A report on the compression of low-pressure steam.

A report on the use of steam-heated steam generators.

In addition, considerable preliminary work was done on a proposed descriptive list of manufacturers and equipment covering the devices used by district steam customers.

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Mr. Day stated that the Meters and Accessories Committee had collected drawings of standard meter installations from the various companies and had them bound in a book which may be inspected by application to the secretary of the association. He also stated that the majority of the committee's work for the year has consisted of collecting information concerning the requirements for demand meters and conveying the various ideas to the manufacturers. He had found flow meter manufacturers rather skeptical as to the satisfactory operation of flow meters for low pressure work. The consensus of suggestions received seemed to indicate that the demand meter should be recording, and mechanically, not electrically, operated.

Mr. Redfield then described the operation of a steam demand meter which his company has produced by adapting the type G, General Electric Company demand meter for use with the Cadillac condensation meter.

John F. Gilchrist, vice-president, Commonwealth Edison Company, Chicago, being present, was called upon for discussion, and remarked that he was much interested to note from the papers and discussion the trend toward a demand rate for the heating industry, as it is practically essential in any utility to recognize demand and consumption as cost factors. With development of the business he felt sure that the necessity will arise for the two rate system. In commenting on the value of such a rate, he pointed out that during the war period, such a rate had carried his company through without the necessity of an increase in rate, because as the consumption fell off, the average revenue rose accordingly.

John W. Meyer introduced Herbert Janvrin Browne, of Washington, D. C., who delivered an able address on "Pending Climatic Conditions." Mr. Browne pointed out that the U. S. Weather Bureau claims that long-range weather forecasting, such as he does, is impossible from a standpoint of accuracy. Mr. Browne, however, has made a study of the fundamental causations of weather conditions, and of his first annual forecast 22 out of 24 of his predictions were correct. It is now admitted that all weather conditions are the result of solar activity.

Referring to solar constant diagrams, Mr. Browne showed the variation of solar constant from year to year, and explained that the sun is a variable star from day to day and over longer cycles. He urges a study of the polar caps of Mars as an indication of solar activity and radiation. The application of sun spots curves is somewhat in dispute, some men claiming that maximum sun spots depress radiation from the earth and others claiming just the reverse.

Using Mercator's projection, he explained the effect of ocean currents on the weather. As the atmosphere is merely a medium for transfer of heat, and it is easily proven that earth does not store heat, it is logical to assume that water is the important factor. Any change in solar radiation has a decided effect on the heat in the waters of the oceans, which heat and the rotation of the earth set up various currents. The waters from the Antarctic are continually flowing north through the Atlantic to the Arctic, where the colder water is displaced by the warmer water from the equator and flows south. The northward flow covers a period of 27 months and the southward 10 months, and there is a period of three years before a change in solar radiation shows in the temperature of the Atlantic. These ocean currents have many effects on the weather. The ocean temperature causes barometric changes, creating high and low pressure areas. Great Britain and Scandinavia have temperatures considerably higher than would be expected in their latitude, because the prevailing winds blow across warm currents.

A study of history, weather conditions, solar conditions, etc., is the basis of long-range weather forecasting. The lunar solar cycle and sunspot maximum cycle occur in a period of 5 years. The period of rising node of the moon in ecliptic is 18.6 years, and three of the latter cycles come into conjunction with the solar cycle, making a 55.8 year cycle affecting the weather. Mr. Browne cited the fact that the weather since last September is parallel to that of 1815-16, confirming his claims. He also cited records of previous floods in the Mississippi Valley, and stated that he had predicted the recent conditions there on June 22, 1926. He called attention to many other historical facts which corroborate and justify the methods used in his forecasting.

As we are now in a three-year period of declining solar constants, the weather in future years depends on whether or not the solar constant rises in the next few months.

In reply to a question as to his prediction for the next year, Mr. Browne stated that the indications at present show a probably very severe winter. The year 1927 should be quite similar to 1816, which was called "the year without a summer." This does not mean that the summer will be continuously cold, but we will have great extremes of both heat and cold. In this connection weather abnormalities should be studied rather than averages, as the average temperature may hold this year but much greater extremes will occur.

## Morning Session, May 20

The first report was that of the Station Operating Committee, submitted by I. E. Powell.

## Station Operating Committee Report

As usual, the report of the Station Operating Committee, I. E. Powell, chairman, embraced a large number of subjects, the whole comprising a manual of 120 printed pages. Included in this report were sections on "Boiler Tests With Air Preheaters and Economizers," by W. A. Herr; "Back-Pressure Regulator for Noncondensing Turbine," by T. N. Lyttle, of the Ohio Edison Company; "Station Operating and Maintenance Costs," by Griswold Dennison; "Missouri River Water as Used for Boiler Feeding," by David Caleb; "Report on First Year's Operation of

3000 KW. Noncondensing Turbine in Law Street Heating Plant of Rochester Gas & Electric Corporation," by C. E. Hague; and "Feed Water Treatment in the Beacon Street Heating Plant of the Detroit Edison Company," by Leo F. Collins.

The balance of the report comprised comprehensive tabulated data on nine important district heating plants including the Cecil plant of the Allegheny County Steam Co., Pittsburgh, Pa.; East 20th Street Heating Plant of the Cleveland (O.) Electric Illuminating Co., Central Steam Heating Plant of the Winnipeg (Can.) Hydro Electric Co., St. Charles Street Plant of the Union Electric Light and Power Co., St. Louis, Fulton Street Plant of the Consumers' Power Co., Grand Rapids, Mich.; Congress Street Plant of the Detroit (Mich.) Edison Co., No. 2 Station of the Kansas City (Mo.) Power and Light Co., Plants Nos. 1 and 2 of the Northwestern Electric Co., Portland, Ore., and Lawn Street Plant Station No. 8 of the Rochester (N. Y.) Gas and Electric Corporation.

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Following Mr. Powell's report, President Seiter introduced V. W. Hunter, who read a paper describing "An Experience with the Orifice Method of Steam Distribution in the Buhl Building, Detroit, Mich."

In reply to questions, Mr. Hunter stated that the thermostatic control system in this building was abandoned; that he believed the orifice method was applicable to any size building, large or small, and that an outside temperature-pressure control is being developed for automatically operating such systems.

L. S. Smith submitted the portion of the report of the Heat Utilization Committee which did not deal with demand studies, and abstracted papers by N. W. Calvert on "Compression of Low Pressure Steam," and by E. B. Robinson on "Use of Steam Heated Steam Generators."

In the Manufacturers' Round Table, H. K. Lanning announced that Warren Webster & Company has purchased the Donnelly systems patents, and shortly will issue descriptive literature on a new system of heating.

Secretary D. L. Gaskill presented the past president's badge to J. E. Seiter, after which President-elect Gillham was escorted to the chair and welcomed into office.

## Entertainment

The Entertainment Committee, under the able guidance of H. C. Kimbrough, capitalized its opportunities to good effect. As in past years, technical sessions occupied the forenoons only, leaving afternoons and evenings devoted to getting better acquainted socially. The one exception to this rule was the Tuesday evening session.

After the session of Tuesday evening the entire party was transported to Brown's at French Lick, where those who were so inclined wooed the Goddess of Chance and the others sympathized or rejoiced with them as occasion demanded.

On Wednesday afternoon all the ladies were guests at a bridge party and tea held at the beautiful Hoosier Club. At the close of an enjoyable afternoon, prizes were awarded as follows: First, Mrs. Hornung; second, Mrs. Butler; third, Mrs. Orr, and consolation to Mrs. L. S. Smith. The men in the meantime were playing qualifying round for the golf tournament to be held on Thursday.

On Thursday another bridge party was held and the winners were: First, Mrs. Killen; second, Mrs. Evans, and Mrs. Donnelly and Mrs. Orr cut for third, Mrs. Donnelly being successful. Miss Stocker received the consolation prize. On Thursday afternoon a great many of the ladies and some of the men availed themselves of the trip provided by automobile to the beautiful Marengo Cave, some twenty miles from the Hotel.

For the men, the annual golf tournament was provided on Thursday afternoon, and the non-golfers were entertained at bowling. A left-handed foursome was at large on the golf course and furnished the usual amount of amusement for the players. Golf prizes were awarded as follows: Low gross, M. J. Czarniecki; low net, J. C. Hornung; kicker's handicap was tied by J. C. Langdell and W. W. Stevenson; high gross to A. C. McClellan. Mr. Hornung keeps the Republic Flow Meter cup polished for the next year. For bowling, prizes were awarded to C. T. Gottwald, H. A. Lawrence and Mr. Hirst.

On Thursday evening the annual banquet of the association was held in the dining room of the hotel. The guest of honor was John F. Gilchrist, vice-president, Commonwealth Edison Company, Chicago, Ill., who presented an interesting address at the conclusion of the dinner. Secretary D. L. Gaskill officiated as toastmaster.

Mr. Gilchrist asserted that the developments indicate that central heat will become almost a necessity. He spoke of the fact that most utilities had a false start due to ignorance of underlying conditions by their promoters, but central heating was fortunate in this respect, inasmuch as it was started by electrical utility men who had been experienced in utility work. "Heat is an elemental requirement," he said, "not only for the preservation of life, but necessary to best efforts. The difficulty of heating is sending people to live in apartments, but this is being offset by the movement to get out into the wide open spaces, which movement will help to develop the central heating business. A reasonable cost is necessary and is near. The costs of isolated plant operation has increased. The increased incomes of the people in general will be a factor in helping to sell the service. This modern method of heating will continue to gain ground, as present-day civilization emphasizes the importance of comfort and care of health."

He went on to point out that there are dangers to be encountered, however. There are two great factors in prosperity in this country, the first of which is the liberty of the individual. The second is the services of our utilities, simplifying work and lessening effort as they do, until the individual's output has increased many times and his income accordingly, enabling him to enjoy life to the fullest. Reflecting on the united value of these factors, no one should be allowed to interfere with the program. Vigilance is necessary, as great utilities are being menaced by government ownership. It is our duty to head off these activities, as the idea is repulsive to our ideas of liberty. The government should be an organization for the enforcement of law, liberty and other activities of general interest, but should not engage in business. Government operation is expensive and not in accordance with our ideals. Government securities probably could not be sold on a competitive business basis.

The indifference of voters is to be lamented as it is their responsibility to build up the country. We should get posted on details of the problem and work for publicity. There is a tremendous volume of public opinion represented by utility employees and their friends. Inform all employees, customers and stockholders as theirs is a common interest. Also keep the representatives of the people in the government posted, to the end that there may be a better general understanding of all factors involved.

Following Mr. Gilchrist's address, Charles M. Newcomb, of Cleveland, delivered a lecture on "The Psychology of Laughter." Mr. Newcomb proved a very able humorist and lecturer, and kept his audience convulsed with his many quips and humorous stories. He propounded the question, "Why does a man laugh?" It is agreed that he laughs because things are funny, but what makes them funny? A laboratory study in laughter was his proposal. After citing numerous comic stories, as specimens for examination, he proceeded with an analysis to discover what made them comic. He pointed out that the world is a universe of law and everything is governed by some law, if we can only find it.

All mental life is based on instinct, but instinct cannot create or cause social order. Civilization or social order places a check on instinct and produces a feeling of restraint which is the cause of tension. Laughter is the means of relieving this tension. Most men are outlaws at heart and resent restraint. Therefore a man laughs at slips and lapses from the regular order, or at ridiculous situations. He laughs at physical slips, language slips, and repartee, but does not laugh at serious slips. For anything to be funny to us, we must know what law of civilization is being violated.

He went on to explain the purpose

and meaning of laughter in our lives. We should use this means of relieving the strain of living under conditions of civilization. Laughter is not a luxury, but a necessity, and we need more laughter. One should not confuse wisdom and gravity, as the wise man can laugh. We must relax our muscles to laugh.

A sense of humor is a sense of proportion, and worry is a loss of sense of proportion. Laughter affords an escape from civilization. Wit and humor are shock absorbers, and laughter is the lubricant of life.

At the close of Mr. Newcomb's lecture, the entire party adjourned to the beautiful Atrium of the hotel, where dancing was enjoyed until midnight.

# Meeting of Manufacturers' Division

WHAT is destined to become an important adjunct of the National District Heating Association, the Manufacturers' Division, held its first annual meeting at the West Baden Springs Hotel, May 16, the day preceding the opening of the convention itself. This division was organized a year ago to foster further extension of the district heating industry. It now includes 28 member companies from which 23 delegates were present at this meeting. A list of member companies and delegates attending follows:

| *Company* | | *Representative* |
|---|---|---|
| American District Steam Co., | North Tonawanda, N. Y. | H. C. Kimbrough |
| E. B. Badger & Sons Co., | Boston, Mass. | H. W. Coombs |
| Banner Rock Products Co., | Alexandria, Ind. | J. L. Elliott |
| | | E. R. Powell |
| C. W. Buttrick Co., | Springfield, Ill. | C. W. Buttrick |
| A. M. Byers Co., | Pittsburgh, Pa. | H. J. Czarniecki |
| Central Heat Appliance Co., | Chicago, Ill. | J. C. Hornung |
| Central Station Steam Co., | Detroit, Mich. | W. K. Abernethy |
| Chapman Valve & Mfg. Co., | Indian Orchard, Mass. | F. S. Kiley |
| Crane Co., | Chicago, Ill. | F. C. Bradbury |
| G. M. Davis Regulator Co., | Chicago, Ill. | |
| C. A. Dunham Co., | Chicago, Ill. | O. J. Prentice |
| Grinnell Co., Inc., | Providence, R. I. | C. E. Mallery |
| Heating and Ventilating Magazine, | New York. | C. W. Presdee |
| Illinois Engineering Co., | Chicago, Ill. | J. C. Matchett |
| Illinois Philip Carey Co., | Chicago, Ill. | W. L. Steffens |
| John R. Kehm Co., | Chicago, Ill. | |
| Michigan Pipe Co., | Bay City, Mich. | |
| Minneapolis Heat Regulator Co. | Minneapolis, Minn. | L. E. Lawson |
| National Tube Co., | Pittsburgh, Pa. | |
| The Nitrose Co., | Peoria, Ill. | H. R. Wetherell |
| Northeastern Piping & Construction Co., | North Tonawanda, N. Y. | A. J. Slade |
| Power Plant Specialty Co., | Chicago, Ill. | |
| Powers Regulator Co., | Chicago, Ill. | W. P. McFarland |
| Reading Iron Co., | Reading, Pa. | C. T. Ressler |
| Republic Flow Meters Co., | Chicago, Ill. | S. C. Vail |
| Ric-Wil Company, | Cleveland, O. | C. T. Gottwald |
| Underground Steam Construction Co., | Boston, Mass. | |
| Warren Webster & Co., | Camden, N. J. | W. Webster, Jr. |
| | | H. K. Lanning |

After the reading of Secretary-Treasurer H. R. Wetherell's report which showed the division to have been extremely active and prosperous during the past year, President Slade appointed a nominating committee consisting of J. C. Hornung, C. T. Gottwald, and C. E. Mallery; and an auditing committee, with H. W. Coombs and W. K. Abernethy as members.

While awaiting the reports of these committees, President Slade called upon various delegates for suggestions or discussion relative to the work of the division. Mr. Lanning, of Warren Webster & Company, stated that a desire for immediate action is natural but counseled patience with a new organization getting under way, and believed that a few years would work many changes, as results must come from within and not from without the organization. His remarks were heartily endorsed by Messrs. Prentice and McFarland, the latter emphasizing the great possibilities of district heating.

Mr. Vail, of the Republic Flow Meters Company, in response to a query, said there was nothing of importance to report regarding flow meter development since the last meeting of the division. Recent years have shown an increase in the use of flow meters for plant output records, but the problem of measuring steam to consumers presents many difficulties which are being studied. At present these studies and development are progressing very favorably.

Secretary Wetherell reports that a list has been prepared of manufacturers and equipment for consumers' premises, and that similar lists are to be prepared for power plant and distribution equipment.

The report of the auditing committee was received and showed the books of the organization in first-class order. The report was unanimously approved as read.

The report of the nominating committee was called for and the slate presented was unanimously elected, as follows:

President, Arthur J. Slade, Northeastern Piping & Construction Co., North Tonawanda, N. Y.; vice-president, W. K. Abernethy, Central Station Steam Co., Chicago, Ill.; secretary-treasurer, H. W. Coombs, E. B. Badger & Sons Co., Boston, Mass.; members of executive committee; H. W. Coombs, J. C. Hornung, F. C. Bradbury.

In opening the meeting President Arthur J. Slade outlined the formation of the Manufacturers' Division, its aims and plans. Due to the fact that the past year has been largely taken up by organization work, the division is just getting under way with its actual working program.

Following President Slade's address there was considerable discussion by a number of the members, the consensus of which seemed to be that the division should formulate a well-defined program and organization for carrying on its work in conjunction with the National District Heating Association. All suggestions made were referred to the Executive committee of the division for consideration.

## With the Manufacturers

Among the manufacturers, most of whose products were described at the Manufacturers' Round Table, were: Ric-Wil Co., Cleveland, O., represented by C. Gottwald; American Temperature Indicating Co., Toledo, O., represented by D. B. Noyes; Flintlock Corp., Detroit, Mich., represented by J. E. Seiter; C. E. Squiers Co., Cleveland, O., represented by Mr. Ogden; Republic Flow Meters Co., Chicago, represented by S. C. Vail; Powers Regulator Co., Chicago, represented by W. P. McFarland; and the Central Station Steam Co., Detroit, represented by J. V. Redfield.

The retiring president, J. E. Seiter, formerly of the Detroit Edison Company, appeared in his new capacity as a representative of the Flintlock Heater Corp., of Detroit, Mich., which is developing a new fin-type radiator.

Norman W. Calvert, of the Detroit Edison Co., Detroit, arrived home to find himself elected president of the Michigan Chapter of the A.S.H. & V.E.

## Thirty Years of Secretaryship for Henry B. Gombers

A remarkable record for tenure of office in a national organization has been made by Henry B. Gombers, for 30 years secretary of the Heating and Piping Contractors National Association.

A heartfelt tribute to Mr. Gombers from the pen of George Hall Morris appeared in the *Official Bulletin* of the association for April, and may be said to represent the feelings of Mr. Gombers' many friends in the industry and of many on the outside with whom he has come in contact.

# What the Heating Contractor Should Know About Law

*By Arthur L. H. Street*

ONCE the heating contractor has slipped on an unforeseen legal obstacle and fallen, all the lawyers in the country may be powerless to restore him to his former position. A bit of foresight is worth a ton of hindsight, when it comes to looking at the legal aspects of everyday business transactions.

There is probably no court decision that better illustrates the point than that handed down as recently as March 8, 1927, by the Iowa Supreme Court, in the case of Des Moines Improvement Company vs. Holland Furnace Company, 212 North-Western Reporter, 550. If defendant company previously had known a point of law that may arise on the installation of almost any modern heating plant it would probably have protected itself against the loss that followed from a misconception of its rights.

### A CASE INVOLVING OWNERSHIP TITLE

The improvement company owned a house and lot in Des Moines and contracted to sell it to Heninger. Heninger, in turn agreed to sell to Hedgecock. Hedgecock arranged with the furnace company to install a heating plant. The house originally was not constructed with that in view and openings were cut in the walls and floors to permit installation of the plant. The improvement company knew nothing of the installation until it was complete. Not receiving the payments due it, the company took the real estate back. The furnace company was not paid for the heating plant, and it removed the furnace, without the improvement company's knowledge or consent. The improvement company sued for damages, and the Supreme Court affirmed a judgment in its favor.

The furnace company unsuccessfully relied on a provision in the contract under which the plant was installed, to the effect that the title to the furnace should remain with the company until final payment, with the right to remove the same in default of payment.

No doubt the contract would have been sufficient to have enabled the furnace company to have reclaimed the plant, as against his customer. But, said the Supreme Court:

"The appellant [the furnace company], *when it installed the furnace* in the manner in which it was done, *was bound to know as a matter of law* that the furnace thus became an integral part of the realty. Whatever rights it may have had under this contract with Hedgecock, the purchaser of the furnace, and which it might have enforced against him, are not available to the appellant as against the appellee, who was the holder of the legal title to the realty, and who had a superior and paramount lien upon all of it for the payment of the purchase price of the real estate. Had the contract for the sale of the real estate contemplated or required that the improvement should be constructed, or had the vendor of the real estate consented to the installation of the furnace, an entirely different question than the one here involved would be presented."

Obviously, therefore, every heating contractor should know that if the buyer of a heating plant is not the owner of the real estate, a contract reserving title to the plant, under contract merely with the buyer, is dependent for its validity upon the uncertainty as to whether or not he will acquire title to the real estate before he becomes in default under the contract. Being so forewarned, business prudence will dictate demand for ample security for payment of the price of the plant.

### WHEN A CONTRACT IS NOT A CONTRACT

Another court decision suggests that it ought to be important to a heating contractor to know when a "contract" is not a contract. "Near" contracts have no more substance than can be found in the atmospheric area lying within the rim of a doughnut. The decision referred to was handed down by the Wisconsin Supreme Court (99 North-Western Reporter, 332). In that case it appeared that an order for a boiler and an order for radiators which were taken by a traveling salesman were signed by defendant, the prospective buyer. But on the same day that the orders were so taken and, presumably, mailed to the salesman's house, the defendant wrote the house asking that they be cancelled. It was found by the court that the house received this countermand before it mailed a card purporting to accept the orders. On these facts, it was decided:

"The orders given by the defendant to the plaintiff's agent were by their terms only to become binding if approved and accepted by the plaintiff company. Up to the time of such approval and acceptance they could be withdrawn or cancelled by the defendant. The whole transaction being by mail, the acceptance took place and the contract became binding at the moment when the postal card of acceptance, properly addressed, was deposited in the post-office by the plaintiff, unless the offer had been previously withdrawn."

In passing, it should be noted that the courts all hold that orders subject to approval by the proposed seller to whom they are addressed are subject to countermands before acceptance, despite the fact that they may contain a clause to the effect that they are not countermandable. The theory of the law on this point is that there can be no contract until both of the parties are bound, and that until that occurs either may withdraw from the negotiations.

And it should be further noted that most of the courts hold that even where a contract has been made, it is still open to either party to break it while it remains unperformed, subject only to liability in damages. Therefore, it is usually held that if the seller receives notice that the buyer repudiates the contract, before the goods are shipped, the seller has no right to go ahead and ship them and recover the agreed price. He is limited to a claim for damages measured by the money loss entailed by the buyer's breach of contract. The seller has no right to recover damages so far as they have been enhanced after he has been notified that the buyer will not carry out his part of the agreement.

### LIMITS UPON AUTHORITY OF PUBLIC OFFICIALS

The contractor who deals with municipal councils or other public authorities is presumed to know that there are various limitations upon the rights of these public officials to bind their respective corporations. For example, it often has been declared by the courts that where an official was directly or indirectly interested in a contract adversely to the public interest, his participation in the award of the contract invalidates it. So the California District Court of Appeals decided in the case of Stockton Plumbing & Supply Company, 229 Pacific Reporter, 1020, that a contract to install plumbing, heating and ventilating equipment in a municipal auditorium was invalidated by the fact that one of the councilmen who voted to award the contract was employed as foreman by the contracting company.

Most cities, counties and other political subdivisions are governed by charter or statutory limitations in matters pertaining to the award of public work. Unless these limitations are observed, whether they relate to the amount that may be expended, or the necessity for award of the contract on competitive bidding, or otherwise, the contract is apt to be void or voidable.

# Heating the Research Residence in Sub-Zero Weather

Research Residence When Test Here Described Was Made

## Warm-Air Furnace Plant Easily Meets Temperature Requirements During January Cold Snap. Relative Humidity Averages 18%

TAKING advantage of a severe cold snap during January of the present year, complete data were secured at the N.W.A.H. & V.A. Research Residence in Urbana, Ill., from which the performance of the warm-air heating plant, under abnormal winter conditions, has been reduced to exact quantities and percentages. These are developed in Circular No. 15, issued by the Engineering Experiment Station, University of Illinois, under the authorship of Vincent S. Day, special research associate professor.

The introductory portion of the bulletin deals with the object of the research residence, its construction and heating plant, and concludes with the statement that "it has been the object of this description of the research residence and the heating plant to show that both were standard, rather than special, and that, therefore, the data for the sub-zero weather, which follow, are such as might be obtained in any well-designed warm-air heating plant."

The circular then outlines the conditions of the test, the data secured and the results and conclusions computed and drawn.

For two days following a heavy snowfall the temperature averaged below zero, the minimum being —16° F. and the maximum 10° F. The mean temperature for the period was —3.1° F.

At the cessation of the snowfall the barometer rose to 30.10 in., and clear skies prevailed during the two days. On the first day the wind velocity rose to 14 miles per hour but subsided to 5 miles per hour on the second day. The wind direction was northwest, shifting to west on the second day.

### TEMPERATURES IN RESIDENCE

The following are the average temperatures at the breathing level in the center of the various rooms of the residence, each temperature being the average of ten readings, five being made each day.

First floor

| | Deg. F. |
|---|---|
| Living Room | 73.1 |
| Dining Room | 71.4 |
| Kitchen | 70.3 |
| Hall | 73.5 |

Second floor

| | Deg. F. |
|---|---|
| E. Bed Room | 79.5 |
| S. W. Bed Room | 74.7 |
| N. W. Bed Room | 72.1 |
| Bath Room | 75.2 |

Third floor

| | Deg. F. |
|---|---|
| E. Dormitory | 69.7 |
| W. Dormitory | 71.3 |

Average 73.1° F.

Variation from average, plus 6.4 and minus 3.4° F.

Outdoor —3.1° F.

During the hours when the outdoor temperature was at —16° F., and when the furnace fire had been without attention for several hours during the night, the average temperature at the breathing level in all the rooms was 71.6° F.

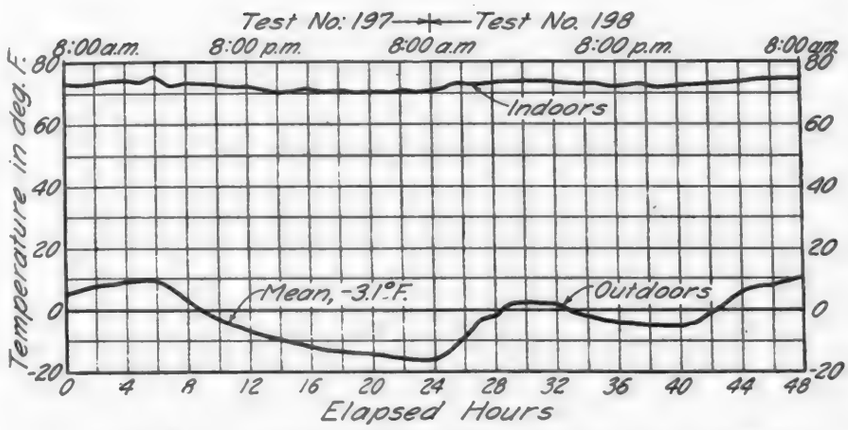
The temperatures given were obtained without dampering or adjusting any valves or registers, all were wide open. This demonstrates that a warm-air plant may be designed to give a good degree of uniformity in temperature in the different rooms heated.

In addition to the temperature at the breathing level, the temperatures 4 in. above the floor and 4 in. below the ceiling were determined by means of shielded thermometers supported on standards, located near the center of each room, as illustrated on the floor plans.

### TEMPERATURE REGULATION

The supply of air to the fuel was under control of a dual, or balanced system of two thermostats. One element in the dining room functioned as a simple thermostat, and another in the furnace operated to limit the furnace temperature. So responsive and positive was the action of this system that the dampers operated to open and close the draft door about once in 15 minutes.

As a result the house temperatures fluctuated only 1° F., and the air was discharged from the registers at the temperature required to make good the heat losses. The fluctuations in register temperature amounted to only 1° or 2° F. Flue-gas temperature fluctuations were confined to a range of 200° F.—a much narrower range than can be obtained with manual control.




**Graphical Record of Outdoor and Indoor Temperatures for the Period of the Test**

#### REGISTER DISCHARGE TEMPERATURES

The average temperature of the air leaving the registers for the two-day period was 135° F. The highest temperature observed at any time was 172° F. at the register in the east bedroom. The lowest temperature average was at the bathroom register, 120° F., but this was enough to maintain the bathroom at 2° F. above the average for the house.

These remarkably moderate register air temperatures exemplify the results which may be obtained with good installation practice.

#### VELOCITY AND VOLUME OF AIR FLOW

The system tested was one of complete recirculation, and returned to the heater, through its three ducts, an average of 47,250 cu. ft. of air per hour during the sub-zero weather. On the assumption that only the air in the open spaces of the house, 16,120 cu. ft. (about 45% of the cubage of the house), would be recirculated, the equivalent recirculations were 2.93 per hour. Actually, each particle of air would not be passed 2.93 times per hour through the furnace, since a certain replacement and exchange due to inleakage at doors and windows is constantly in progress. Hence the term equivalent recirculations has been employed. It is this rapid turnover in the air contents of the house, combined with the admixture of fresh air, which constitutes the ventilation feature of warm-air heating.

#### COMBUSTION RATE

Stove-size anthracite was the fuel used, fuel being charged four times daily and the ashes removed once. The fire depth ranged from 10 in. at starting to 18 in. at end of each test. Under the conditions the combustion rate was 3.3 lbs. coal consumed per square foot of grate per hour, and firing periods of 8 hours were easily possible.

#### DRAFT

To produce this combustion an average head, or draft differential, of 0.04 in. of water was necessary to overcome the resistance of the grates, fuel bed, and furnace passes, and accelerate the flow of air and gases. With the particularly narrow setting of the draft door entailing considerable additional resistance the total draft required of the chimney was 0.14 in. of water.

The draft values noted were taken with this damper set about one-half closed.

#### CAPACITY AND EFFICIENCY

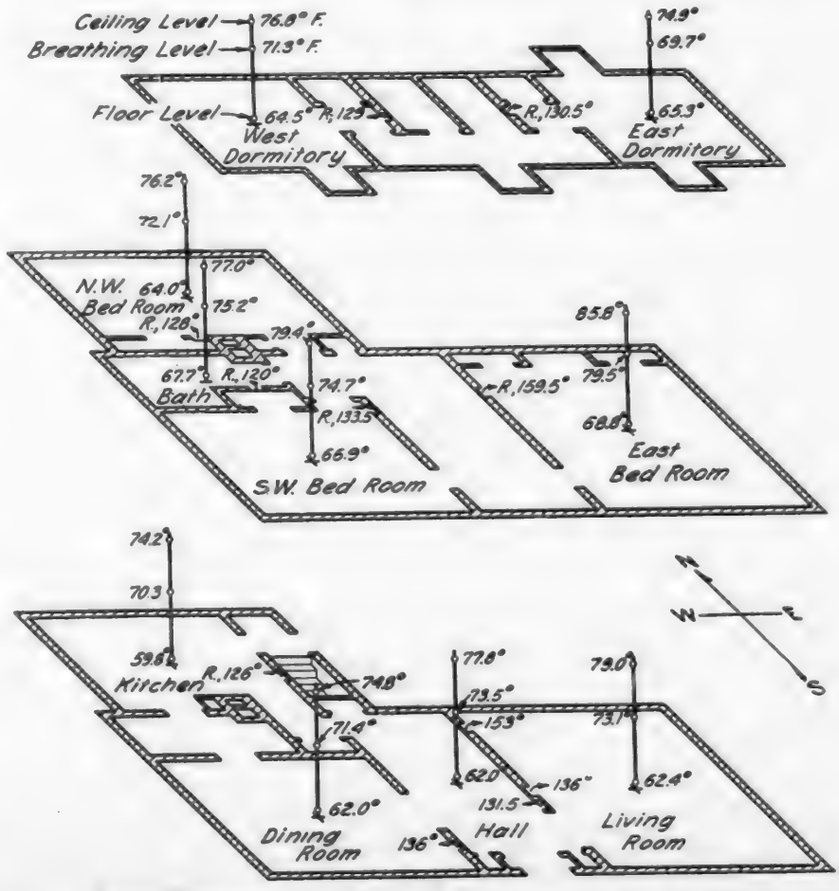
At the bonnet collars of the furnace a capacity of 72,600 B.T.U. per hour, of the total of 123,300 B.T.U. per hour of the fuel, was available, and the efficiency of the heater proper was therefore 59%. Of the 72,600 B.T.U. per hour capacity available at the furnace collars, 58,500 B.T.U. per hour, or 80.5%, was available at the registers. Thus the loss of heat between heater and room amounted to only 19.5%.

Observation of the temperatures in the path of the flue-gases showed the following results, the loss in temperature meaning that the heat was given up to the surrounding structure:

| | Deg. F. |
|---|---|
| Temperature leaving furnace | 498 |
| Temperature at base of chimney | 271 |
| Temperature at top of chimney | 152 |

The net loss in heat at the chimney top corresponding to this temperature at 152° F., together with carbon monoxide and moisture losses, amounted to 11% of the heating value of the coal. The overall efficiency of the heating system in the residence therefore was 89%. As a check on this efficiency the calculated heat loss of the house for the particular weather condition, estimated by independent computers at 112,500 B.T.U. per hour, may be compared with the gross heat of the fuel consumed, 123,300 B.T.U. per hour, giving an efficiency of 91%.

It appears, therefore, that 48% of the heat of the fuel consumed was actually delivered at the registers, and another 41% found its way into the building by radiation and convection from smoke pipe, chimney, casing and piping. As further evidence of this indirect flow of heat it was observed that the temperature of the air between the joists over the furnace was 88° F. This is more than 20° F. warmer than the air above




**Room Temperatures and Register Temperatures for All Rooms**

the first floor, hence a definite transmission of heat through the 2 in. of flooring was in progress. Simultaneously, the basement temperature at the breathing level did not rise above 62° F. or 26° F. less than that of the air above the furnace and between the joists.

### EFFECT OF SNOW ON ROOF

During the two-day period covered in this discussion the copper-shingled roof of the residence was completely covered with snow to a depth of about 6 in., and the effect on the temperature within the house was very marked. Thermocouples are attached to the shingles, and others are suspended in the rafter and attic spaces beneath. The temperatures observed at these points during the presence of snow, and at another time during the absence of snow, show the remarkably insulating effect of snow, and indicate the benefits to be derived from the use of commercial roof insulations.

PARTIAL SUMMARY OF OBSERVED DATA AND CALCULATED RESULTS

| | |
|---|---|
| Coal fired per day | 232.5 lbs. |
| Coal burned per hour | 9.4 lbs. |
| Combustion rate per sq. ft. grate per hour | 3.3 lbs. |
| Temperature outdoors, mean | —3.1° F. |
| Temperature, average of 10 rooms | 73.1° F. |
| Temperature, return grilles, mean | 66.4° F. |
| Temperature, bonnet, average | 151.5° F. |
| Temperature, boots, average | 141.0° F. |
| Temperature, registers, average | 135.0° F. |
| Temperature, flue gas, at furnace | 498° F. |
| Temperature, flue gas, base of chimney | 271° F. |
| Temperature, flue gas, top of chimney | 152° F. |
| Temperature, furnace casing | 116° F. |
| Temperature, basement | 61° F. |
| Heat of coal burned | 123,300 B.T.U. per hr. |
| Heat at bonnet collars (= Capacity) | 72,600 B.T.U. per hr. |
| Heat at boots | 63,800 B.T.U. per hr. |
| Heat at registers | 58,500 B.T.U. per hr. |
| Heat loss of house | 112,500 B.T.U. per hr. |
| Heat loss at chimney top | 13,500 B.T.U. per hr. |
| Efficiency, as of furnace proper | 59% |
| Efficiency, as of registers | 47.5% |
| Efficiency, of pipes and stacks | 80.5% |
| Efficiency, overall of heating plant | 89% |

EFFECT OF SNOW ON ROOF AND ATTIC TEMPERATURES

| | With Snow deg. F. | Without Snow deg. F. |
|---|---|---|
| Outdoor temperature | —2 | 1 |
| Shingles temperature | 27 | 8 |
| Rafter air spaces | 54 | 42 |
| Room below, near ceiling | 74 | 66 |
| Diff. between air space and outdoors | 56 | 41 |
| Diff. between room and air space | 20 | 24 |
| Diff. between room and outdoors | 76 | 65 |

Beneath the snow the shingles were actually warmer than when there was no snow, a condition which shows the blanketing effect. This blanketing effect made the air beneath the roof 12° F. warmer than when the snow was on the roof, and reduced the temperature differential between air below the ceiling and air above the ceiling from 24° to 20° F. This differential reflects the relative loss in heat through the ceiling and indicates a saving of the order of 17%, which can be credited to the presence of snow during this period.

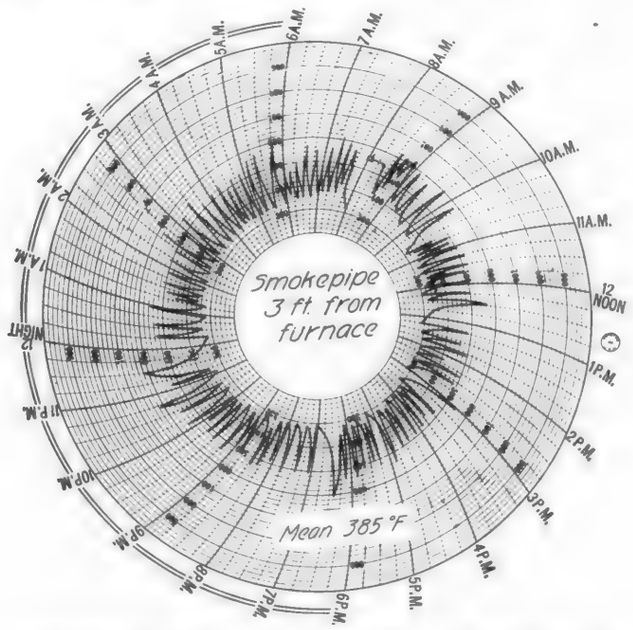
### HUMIDITY AND EVAPORATION

On these particular days the evaporator in use consisted of a concrete basin formed within the base ring of the heater. The water level, controlled by a float, stood at a depth of 1.5 in.; and approximately 6.5 sq. ft. of surface were exposed to air currents and to radiant energy from the hot furnace castings.

A thermometer suspended in the water in this evaporator showed a maximum temperature of 120° F. The daily evaporation in the sub-zero weather was 61.6 lbs. of water, or 7.4 gal. Expressed on an hourly basis this evaporation was 2.56 lbs., or 0.31 gal.

The relative humidity actually obtained in the residence averaged 18%, which is scarcely ample for bodily comfort at the house temperature of 73° F. but with the additional evaporation from normal domestic processes there is no doubt that most satisfactory humidity, comfort, and health conditions would exist in the research residence.

It should be remembered that the windows and doors were not weather stripped nor was special care taken to seal the frames in place at the time of building. The walls were not insulated or filled, and the inner wall surfaces of rough sand plaster have never been painted.




**Temperature Recorder Chart Showing Smokepipe Temperature and Frequency of Damper Operation**

### ESTIMATE OF AIR CHANGE

The outdoor relative humidity was 100%, and the indoor humidity 18%. The water vapor supplied, 2.56 lbs. per hour, is sufficient to humidify 14,500 cu. ft. of the outdoor air to 18% humidity at 73° F. This quantity of air, 14,500 cu. ft., would appear to be the hourly inleakage and in terms of the circulating air of the house, 16,120 cu. ft., would amount to 0.90 air change per hour. This method of estimating air change is subject to uncertainties, such as unaccountable moisture given up from the building materials, and the result must be considered only as very approximate.

### CONCLUSION

The results obtained were extremely satisfactory, both as regards effectiveness of heating and economy of operation, and warrant the following conclusions:

A good degree of uniformity of temperature between the various rooms can be obtained with a well-designed warm-air heating system.

Moderate temperatures at the regis-

ters, 135° F., in this case in the coldest weather, are characteristic of a well-designed warm-air heating system.

The rapid turn-over of the air contents of the house, combined with the admixture of fresh air, constitutes a valuable ventilation feature of warm-air heating.

High overall efficiencies can be obtained with a warm-air heating system; in this case the net loss of heat from the chimney was 11%.

Satisfactory relative humidity can be obtained with a warm-air heating system.

# Corridor Venting and the Cost of Recirculation

BASED on the premise that diffusion is the big problem in ventilation, the argument is advanced by J. M. Robb, engineer for the Herman Nelson Corp., Moline, Ill., that corridor venting furnishes the key to the solution of the problem of air supply for schoolrooms. Mr. Robb also gives an interesting comparison of the relative cost and time element involved in recirculation and all fresh air supply and gives data to prove that recirculation under ordinary conditions requires more heat.

In discussing corridor venting, he says: "If we inject air into a room even in a great volume at a low velocity, and if that room has large vent ducts, the inevitable results are that we will have stratification instead of diffusion. The incoming air, following the path of least resistance, will flow toward the vents, especially if they are located in the ceiling or have long ducts leading to the roof.

"On the other hand, if we inject the air at high velocity toward the ceiling, and have restricted vents near the floor-line opening into the corridor, we will build up a pressure in the room slightly above atmospheric pressure. This aids diffusion. The aspirating effect of the high-velocity jet, its impingement on the ceiling and the resistance of the room air pressure, combine to create a swirling movement or air turbulence that thoroughly mixes the incoming air with the air in every nook and cranny of the room. This physical fact has been demonstrated to the eye by means of smoke bombs. It has been demonstrated to the satisfaction of the reasoning intelligence by temperature tests.

"Temperature tests taken in so-called plenum ventilated rooms where the air is brought in at relatively low speed, and where there are large vents provided with ducts leading upward, have shown high ceiling temperatures and low floor temperatures—conclusively proving stratification or lack of diffusion.

"In a similar room, with the air supply coming in vertically at high velocity, with restricted ductless vents, into the corridor, ceiling and floor temperatures have been found to be only a degree or so apart, equally conclusive proof that stratification has been broken up and diffusion maintained.

"As a result of practical tests and experience, engineers and others who were seeking real ventilation results began to look with favor on corridor venting, in connection with unit ventilation.

### PRINCIPLE OF CORRIDOR VENTING

"In corridor venting a restricted vent opening discharges the air directly into the corridor. Experience has proven that even these vents to the corridor are seldom really necessary, as the leakage under doors, through walls, and around windows, is sufficient for the egress of air in ordinary building construction. Under such conditions it has been amply demonstrated that without any provision for vents whatever, the plenum condition of the room is raised to a point where static pressure materially impedes the stream of fresh air being blown in. There are, however, no objections to providing orthodox vent openings to the corridor and many architects and engineers to-day are advocating corridor venting as a happy compromise between the elaborate flue system of venting and the more radical advocacy of no vents at all.

"Corridor venting eliminates all vent flues, except those from toilets, laboratories, domestic science, and similar rooms that produce odors.

"Because each classroom and similar unit of space receives its own individual supply of out-of-door air, under the slight pressure produced by the unit ventilator with motor-driven fan, no flue action is necessary to aid air flow.

"Indeed, the high velocity vertical jet action of the unit more uniformly diffuses the out-of-door air throughout the room it serves without the vent flue.

"The surplus air is passed from the room to the corridor in various ways, any one of which is satisfactory as long as the outlet is at the floor line, and as long as the total free area of outlet is less than 18 sq. in. per 100 cu. ft. of air per minute to be moved.

"The outlet to the corridor may be a grille in the classroom door, or the classroom door may be simply cut off at the bottom two or three inches; or a wall opening at the floor from the classroom to the corridor may be used.

"In the case of coat rooms or lockers, the classroom air is passed into the coat room or locker at the floor line and taken out into the corridor at the ceiling line.

"A roof ventilator with tight-closing damper, either manually or pneumatically operated, with area not exceeding 15 sq. in. per 100 cu. ft. of air to be moved per minute, is provided at any convenient point.

"If the building is a multi-story building, the air flows up the stair wells to the top-floor corridors.

"The most common objections against corridor venting are hazard in case of fire, and annoyances from sound passing from corridors to classrooms.

"In every instance where sound tests have been made, with corridor venting, it has been found that corridor sounds are no more perceptible in classrooms with it than without it.

"Sound travels with air currents. Anyone who has tried to shout against the wind, has a self-evident demonstration of the impossibility of corridor sounds to flow into classrooms through properly-designed openings for corridor venting.

"As to fire hazard, the general belief is that in case of fire the vent flues would carry off the smoke, so that where classes filed out of rooms in which fires might occur, the smoke would not pass along with them, but would escape up the vent flues.

"In the case of fire with classroom doors open, the smoke would flow along the lines of least resistance to the corridors. It is an axiom in fire insurance reckoning, that the fewer openings between floors in a building, the less the hazard is. Corridor venting applies the axiom more perfectly than any other method of ventilation.

"Corridor venting," concludes Mr. Robb, "makes school buildings, in combination with unit ventilators, safer and more sanitary. It saves money in installation by at least the elimination of the vent flues, and it often permits a reduction of building cubeage for the same working space.

"Corridor venting saves money in operation, to the extent that the classroom air is utilized to warm corridors."

### HEATING PERIOD LONGER WITH RECIRCULATION

In discussing the time element involved with recirculation and with fresh air, Mr. Robb points out that if it were possible to heat a room quicker with recirculated air, recirculation would be justified as an economy measure if the room were not occupied. It would seem logical, he states, that if a machine recirculates the same air over and over again, a room would heat quicker and with less cost than if outdoor air was brought in through the ventilator and heated. There is, however, he points out, a factor that enters into the picture and knocks out the economy claim of recirculation. This factor is air leakage.

When the unit ventilator operates as a recirculating medium, the plenum condition of the room is destroyed. Consequently, the air that is heated through the ventilator must also heat the cold air which infiltrates through the building leaks.

Where the plenum condition of the room is destroyed we do not get the diffusion of heat that we would under a plenum condition. The result is that we have ceiling temperatures high and floor temperatures low. Before the room can be gotten up to a comfortable temperature to the breathing line, a great reservoir of warm air has been stored up against the ceiling where it does the occupants no good. We will assume building leakage of 1000 cu. ft. of air per minute per classroom. This assumption is based on the observation of 5 years of continuous tests. This air leakage must be warmed. If it is warmed by diffusion from recirculation, the leakage is in no way checked. It may even be accelerated. If, however, we take air directly from out-of-doors and pass it through the unit ventilator, we put the room in plenum condition and check the infiltration of cold air. This infiltration is checked on account of the back pressure built up by the volume of air that is put through the unit.

In addition to this fact, on account of complete diffusion owing to the plenum condition, there is little difference between the temperature at the ceiling line and at the floor. This means that a lesser gross amount of heat must be maintained in the room to make everyone comfortable because this heat is evenly distributed.

To the practical educator, who knows the frailties of human nature, the idea of recirculation would not appeal, even though it would bring about an economy, for it is a matter of common observation that the janitor or whoever is in charge of the ventilating units will often abuse the recirculation privilege by not only using the ventilator as a recirculating heat producer when the room is not occupied but will be apt to continue recirculating when the room is occupied. Thus the purposes of ventilation are defeated.

In support of his conviction Mr. Robb cites a number of tests made in schools in Joliet, Ill., Harrisburg, Pa., and Akron, O., indicating that where the windows are without weather stripping the inleakage is sufficient to overcome any advantage of recirculation.

## Getting Gas Into the Home

**A scheme for having gas equipment installed in homes when built, to be paid for by the builder at the time of erection, but with an arrangement providing for the payment by the home owner covering a period of ten years, is proposed by J. E. Davies, of The Peoples Gas, Light and Coke Company, in the American Gas Association monthly for April. Mr. Davies developed the idea from his observation of advertisements of houses for sale which featured their equipment in the way of concealed plumbing, coal-fired heaters, radio cabinets, etc. The absence of the gas man in the picture made an impression upon him.**

Mr. Davies' proposal is to interest the speculative builder in equipping homes with gas-fired appliances, such as water heaters, incinerators, refrigerators and clothes dryers. He told how his own company, at least, would be willing to run advertisements in the newspapers, calling attention to homes so equipped. He also stated that his own company would place at the disposal of the builders its house-heating engineers and the services of its architecural department.

Another argument advanced for this practice was that the prospective buyer will surely want to modernize his home at some future day, if not now. If he does it now, through installing complete gas-fired equipment, he will save the expense later of discarding equipment for which he is paying good money today. Furthermore, he will be able to install equipment at a minimum cost. If desired, states Mr. Davies, the homeowner could have the price of the gas equipment covered in the general mortgage.

## Sales Aid for Heating Contractors

To meet a demand for sales letters featuring heating equipment, the National Trade Extension Bureau has compiled a booklet of 63 sales letters and 6 collection letters. It also has included a comprehensive outline of how to plan and conduct a mail sales campaign for heating equipment. The letters were reviewed and revised by one of the country's foremost authorities on business-getting letters. The book can be obtained from the National Trade Extension Bureau, Evansville, Ind., at $1.50 per copy.

# Research Laboratory to be Used for Commercial Investigations

THE new arrangement under which the A.S.H. & V.E. Research Laboratory will undertake to carry out investigations for other societies or organizations, has been approved by the society's Committee on Research of which S. R. Lewis is chairman. This form of agreement undertakes to carry out research work as follows:

AGREEMENT FOR LABORATORY SERVICE

*1*—The laboratory of the AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, hereinafter called the Laboratory, proposes to conduct research investigation for.....hereinafter called the client.

*2*—This service may be performed at whatever laboratory either in Pittsburgh, or elsewhere, as the Laboratory may deem most expedient.

*3*—The investigation shall cover a minimum period of..... years, with the right of cancellation by either party upon one year's written notice.

This provision is desirable in view of the careful preparation and checking required by all research work.

*4*—The yearly amount which the client will be expected to expend with the Laboratory for this service, is approximately ..... dollars per year.

This provision is desirable in order that the Laboratory safely may assign members of its staff to the work, possibly withdrawing them from other service, and so that the Laboratory may, if necessary, engage new men; also so that the client may have a clear idea of the approximate yearly cost of this service to him.

*5*—The conduct of the investigation shall be under the full control of the AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, through the Research Laboratory.

Methods of interpretation, measurement, etc., will be laid down by a Technical Advisory Committee appointed by the Control Board of the Laboratory, not necessarily members of the AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, and possibly including representatives of the client.

*6*—All of the records of the investigation shall be the property of the Laboratory and shall be kept on file at the Laboratory.

*7*—The AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS shall have the exclusive right to publish the results of the investigation.

*8*—No publicity shall be given to any of the results of the investigation prior to the publication of these results by the Laboratory, except upon the direction of the Committee on Research of the AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS.

*9*—The Laboratory will furnish reports of progress and development at least two times per year.

*10*—The Laboratory retains the right to exclude from presence at any tests, anyone who in its opinion might be inimical to disinterested results, although it is understood that the Technical Advisory Committee shall have the benefit of all possible suggestions and criticisms from all interested parties, in developing a test program.

*11*—The client agrees to pay the Laboratory for this service, on the basis of actual cost of labor and material used in the specific work, plus a like amount as a contribution to the general research fund of the society.

*12*—Payments for this service shall be made quarterly in advance upon statements and estimates of the Director of the Laboratory, as follows:

The first payment shall be based upon the said Director's estimate; the second and all other payments except the final payment, shall be based upon the said Director's statement of balance due for past work, plus his estimate for the ensuing quarter, and the final payment (to be made not more than thirty days after the work is completed) shall be for the balance due.

# Building Cost Data for Cheap Versus Quality Construction

## Upkeep Figures for a Number of Homes Costing from $9,000 to $23,000 Justify Quality Work

*By Clyde A. Mann*

"BY reduction of upkeep and fuel expenses"—this is the solution of the problem of reducing building costs. Studies made in connection with "rating" buildings, on the basis of ten-year costs, serve to show that a better *liaison* between the heating engineer and the architect is inevitable because it will serve to reduce secondary costs in amounts many times as great as the increase of first costs of buildings, due to the use of high-grade materials and workmanship.

To illustrate the way better construction, costing from 5% to 10% more, actually serves to reduce costs of buildings from 25% to 50% over a period of ten years, Better Building Registry has compiled some tables based on the actual figures for a number of homes costing from $9,000 to $23,000. The conservation of fuel furnishes big credits on account of both reduced waste in chimneys and reduced heat loss through walls, windows, etc. A typical table is given herewith.

The heating engineer and the architect are charged to-day with the responsibility of reducing the operating costs of buildings. Heretofore the need for this was less. It has now become imperative. Costs of buildings must be reduced and can be materially, but secondary, as well as first, costs must be considered.

The poor building standards prevalent and complained of by life insurance loan officials cannot continue. They violate the best practice and well-known and accepted facts about good construction. The problem has been to get old systems changed. With architects making specifications regardless of the need for conservation of heat, and then blandly asking the heating engineer to carry the blunder a step further and install boilers and radiation in excess of requirements had the specifications been better, is a mistake which is costing America millions annually.

Rating of buildings on the basis of fuel cost and comfort, as well as permanence and fire-safety, has disclosed some facts about the big buildings and dwellings which urge more scientific management.

Take the case of an enormous new hotel in Chicago which will require train loads of coal yearly for its heating. It was pointed out to the heating engineer that the fuel waste would be from 1500 to 2000 tons a year. In fifty years this represents 75,000 tons, which will cost fully $375,000. The reduction of heat loss through the walls and windows would have accomplished an enormous saving in boilers and radiation. Although I had the backing of the heating engineer of the great architectural organization in urging a change of specifications, the head of the architectural firm said to me:

"The plans have cost $250,000. If we start changing them they will have to be changed all the way through. We can't ask the owner to pay the cost of those changes. We won't pay it. Nothing doing."

BUILDING AND UPKEEP COSTS FOR CHEAP VS. QUALITY CONSTRUCTION

| | "CHEAP CONSTRUCTION" *with no architect's fee* | | | | "QUALITY CONSTRUCTION" *Includes architect's fee* | | | |
|---|---|---|---|---|---|---|---|---|
| | Per Cent | First Costs | Secondary Costs | Total Ten Years' Costs | Per Cent | First Costs | Secondary Costs | Total Ten Years' Costs |
| Screens | .9 | 135 | 270 | 405 | 1. | 150 | — | 150 |
| Flashings Downspouts | .7 | 105 | 210 | 315 | 1.1 | 165 | — | 165 |
| Excavating and Grading | 1.8 | 270 | — | 270 | 1.8 | 270 | — | 270 |
| Hardware | 2.0 | 300 | 300 | 600 | 2.9 | 435 | — | 435 |
| Electric Fixtures and Wiring | 2.7 | 405 | 270 | 675 | 3.25 | 487.50 | — | 487.50 |
| Roofing | 5.4 | 810 | 810 | 1620 | 6. | 900 | — | 900 |
| Masonry | 9.4 | 1410 | 465 | 1875 | 10. | 1500 | 100 | 1600 |
| Stucco, etc. | 10.6 | 1590 | 310 | 1900 | 10.6 | 1590 | 100 | 1690 |
| Plumbing | 9.3 | 1395 | 700 | 2095 | 9.9 | 1485 | 100 | 1585 |
| Heating | 7. | 1050 | 250 | 1300 | 7.7 | 1150 | — | 1150 |
| Carpentry | 27.2 | 4080 | 500 | 4580 | 29.2 | 4380 | — | 4380 |
| Painting and Glass | 4.5 | 675 | 800 | 1475 | 6. | 900 | 450 | 1350 |
| Financing | 8.7 | 1305 | — | 1305 | 1.6 | 240 | — | 240 |
| Architect's Fees | — | — | — | — | 4.5 | 675 | — | 675 |
| Landscaping | 3.0 | 450 | | 450 | 3. | 450 | | 450 |
| Builder's Profit | 6.8 | 1020 | — | 1020 | 9.4 | 1410 | | 1410 |
| Totals | 100 | 15000 | 4885 | 19885 | 107.95 | 16187.50 | 750 | 16937.50 |
| Credit items for fuel savings | | | | | | | | 2250.00 |
| Net cost "Quality" house | | | | | | | | 14687.50 |
| Saving, "Quality" house compared to "Cheap" house, 10 years | | | | | | | | 5197.50 |

PER CENT OF SAVING DUE TO QUALITY CONSTRUCTION, 36%.

*Copyright*, 1927, *Better Building Registry*

The explanation in this case was that the plans and specifications had been made up without consulting the heating engineer, who knew best how the fugitive heat could be kept on the job. When the specifications had been completed and the damage all done, the heating engineer was given the plans with instructions:

"Heat this building."

All that was left to do was to figure what the heat loss would be through the brick facing and tile backing, duly plastered, and having radiation and boilers adequate to meet those requirements.

This is a concrete example of what is going on. When loans are made with relation to the "rating" of a building the blunder becomes obvious and is corrected. But at the present time the tremendous pace of building is adding hourly to America's burden of waste.

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## Glenn C. Carnahan Joins Clow Organization

Glenn C. Carnahan, manager of the house and water heating division of the Peoples Gas Light and Coke Company, Chicago, since 1921, recently resigned to accept the position of general manager of the gas heating department of James B. Clow & Sons, Chicago. Mr. Carnahan takes the place of E. V. Dailey, who, after eleven years with the Clow company, has retired, and will reside in California.

Mr. Carnahan is widely known in the gas industry throughout the United States. An authority on gas heating, he has been in constant demand as a convention speaker, and many articles under his name have appeared in A. G. A. and other publications. He is a graduate of Armour Institute of Technology, Chicago. During the summer of 1926 he was on the faculty of the summer course in Industrial Gas Engineering at the University of Illinois, and again he will be at the university this year.

Glenn C. Carnahan

When he took over the heating division of the Peoples Gas Light and Coke Company, there were almost no central gas heating plants in the city. To-day, there are over sixteen hundred central gas plants, and thousands of Gasteam installations in Chicago. During his last year with the Peoples Gas, the heating load is estimated as having increased 557,897,000 cu. ft. by the sales of appliances through his department.

The appointment of Mr. Carnahan opens another chapter in the development of James B. Clow & Sons in the gas heating field. Clow is known as a pioneer in gas heating, having introduced the Gasteam radiator in 1901. The first Gasteam radiators ever manufactured were sold in Birmingham, England, because there was no market for them at home. Since then, the Clow distributing organization has been made national in scope with sales representatives in all principal cities. Both Mr. Carnahan and the company he now represents feel that there is a tremendous future for gas heating of both the unit and central type, and backed by their national sales organization, which is being continuously expanded, they expect to keep in the forefront of all developments along these lines.

# Tunnel for Study of Combustion Phenomena at Carnegie Institute

FOLLOWING a special course in heat and combustion engineering for graduate students, the next semester in the mechanical engineering department at Carnegie Institute of Technology, Pittsburgh, will inaugurate an undergraduate course in heat engineering. The importance of the subject and the evident demand for work along this line has been demonstrated by the success of the graduate school.

The New Tunnel in which Combustion Phenomena Will Be Studied at the Carnegie Institute of Technology

Provision for research in combustion problems has been widened by the construction of a combustion chamber or "tunnel," as it is called, said to be the single example of such equipment in college laboratories. The tunnel consists of an oblong furnace to which various kinds of burners and combustion devices can be attached at one end. It is provided with observation holes through which flue-gas samples can be taken and through which temperatures of the flame and of the furnace walls can be observed. Above the rear end of the tunnel there is a "Calco" recuperator by means of which the combustion air can be preheated to about 800° F. The piping and blast ducts are so arranged that the furnace can be supplied either with cold air or with hot air. In the former case the hot air goes directly to the stack so as to protect the recuperator from being burned out. A carborundum recuperator with "core busters" is being installed at the side of the furnace. This recuperator is designed for preheating the air to a very high temperature.

Instruments have been provided for measuring temperatures and for analyzing fuel as well as flue gases. All fuel and air quantities are being measured.

At the present time natural gas serves as fuel but pumping and heating equipment is on the ground for using oil and tar as fuel and is now being installed. The mechanical laboratory also has a gas producer so that studies can be made with producer gas. Arrangements also are being made to remove the "snout" or flared section which lies between the burner proper and the combustion tunnel, and to replace it either by parts of high temperature furnaces or else by grates and stokers for the purpose of studying the combustion of coal and of the gases rising from the fuel bed.

# Figuring the Heating Load in Chicago

## How the Gas Companies Are Using the Degree-Day Method to Get an Accurate Line on the Year's Fuel Requirements

*By Glenn C. Carnahan*

The Peoples Gas Light and Coke Company, Chicago

*(From a paper on "Factors and Influences that Promote the Sales of Gas for Heating," presented at the convention of the Illinois Gas Asociation, in Springfield, Ill., March 17-18, 1927.)*

A HOME usually retains enough heat to be comfortable when the outside temperature averages 60° F. for the day. Heating plants in homes rarely are put in operation when the daily average temperature is 60° or higher. The records of the United States Weather Bureau show that the daily average temperature for Chicago normally is below 60° from October 4 until May 21. The normal or average heating season for Chicago is, therefore, a period of 230 days. The average temperature for this period is 38.0° F.

Assume that the average home will be kept at 70° for 16 hours of the day and at 55° for 8 hours of the day, the total number of hours in a heating season during which the home will be kept at 70°, is 230 × 16 or 3680 hours, and the number of hours at 55° is 230 × 8 or 1840.

The amount of heat required in a home is in proportion to the temperature difference between the inside and the outside of the home, as well as to the length of time this temperature difference exists. The term used in combining temperature difference and time when determining the heat requirements for a home is "degree-hour." A "degree-hour" is an hour during which the average outside temperature is one degree lower than the average inside temperature. An hour during which the average outside temperature is 50° and inside is 70° is, therefore equivalent to 20 degree hours.

The difference between an inside temperature of 70° and the average outside temperature of 38° for the Chicago heating season is 32°. This average temperature difference is maintained for 16 hours of the day. The average temperature difference for the 8 hours of the night is between 55° and 38° and is 17°. The number of degree-hours in a heating season is 149,040 (3680 × 32) + (1840 × 17).

### CALCULATION OF HEAT REQUIREMENTS PER SEASON

The figure of 149,040 degree-hours, when multiplied by the hourly B.T.U. loss from a building per degree difference between inside and outside temperature, will give the total heat loss per season. This is the amount of heat which must be replaced by artificial means in climatic conditions equal to Chicago.

### CALCULATIONS OF FACTOR FOR 70 DEGREE HOUR HEAT REQUIREMENTS

It is customary in many cases to calculate the hourly heat losses from a building on a basis of a 70-degree difference between the inside and the outside temperature. In these cases, dividing 149,040 degree-hours by 70 gives a factor 2129, which, multiplied by the hourly heat loss calculated on the basis of a 70° temperature difference, also gives the total heat loss per season.

If the heat loss is figured for an inside temperature of 70° and an outside temperature of minus 10°, the 149,040 degree-hours should be divided by 80. This gives a factor 1863 which should be used in connection with heat losses and radiation figures which are based on minus 10° outside temperatures.

Similar constants can be worked out for any climatic conditions, other than those correspnoding to Chicago, by the use of the United States Weather Bureau reports.

The cubic feet of gas required per season will be the yearly heat loss in B.T.U. divided by the available B.T.U. per cubic foot of gas. The available B.T.U. per cubic foot of gas is the total heat content of the gas times the efficiency of the heating plant.

The cost of the gas per season in dollars will equal the cubic feet of gas required, per season, times the average price of the gas in dollars per cubic foot.

### DEGREE-DAYS USED IN FORECASTING GAS BILLS

In making estimates, the unit combining temperature difference and time is the degree-hour. In making yearly forecasts from the monthly gas bills, the larger unit, a "degree-day," is used. A "degree-day" is a day in which the average outside temperature is one degree lower than the average inside temperature. Since forecasting from monthly gas bills is based on ratios and proportions, 70° is used as a standard average inside temperature.

The average outside temperature during the heating season for Chicago is 38.0°, and the season extends over 230 days. Therefore, a normal heating season in Chicago consists of 230 × 32 or 7360 degree-days. If a certain period of time, for example, one month, has an average temperature so as to be equivalent to 736 degree-days, the gas consumed for that period should be equivalent to 10% of the gas consumption for a normal or average heating season. Similarly, 368 degree-days would be 5%; 1104 degree-days would be 15%; 1472 degree-days would be 20% of a heating season, and so on.

### MONTHLY FUEL REQUIREMENTS IN PER CENT

The average monthly temperatures, together with the monthly fuel requirements for a normal heating season in Chicago, are as follows:

| | Temperature | |
|---|---|---|
| | Deg. F. | Per cent |
| October (4-31) .... | 53.4 | 6.3 |
| November ..... | 40.1 | 12.2 |
| December ..... | 28.8 | 17.4 |
| January ..... | 23.7 | 19.5 |
| February ..... | 26.3 | 16.6 |
| March ..... | 35.3 | 14.6 |
| April ..... | 46.9 | 9.4 |
| May (1-21) ..... | 55.8 | 4.0 |
| | | 100.0 |

These figures for the monthly fuel requirements in a normal season are, of course, average figures. They may vary somewhat from month to month and, in fact, even the yearly fuel requirements may vary 5% or even 10% from the normal. These variations are not serious as they can be readily explained to customers.

### DAILY FUEL REQUIREMENTS IN PER CENT

Some gas meters are read on every working day in the month and, therefore, over 90% of the meter readings are for periods other than calendar months. Provision must be made for calculating the fuel requirements for any period of time, as compared with the requirements for a normal heating season. For this purpose, a record is kept of the average outside temperature for each day. This figure is subtracted from 70° and then divided by 7360. The quotient, when multiplied by 100, is the per cent. of a normal season's fuel required for that day. For example: If the average outside temperature for December 25 was 20°, the average temperature difference between inside and outside for the day was 70°—20° or 50°; hence, December 25 was equivalent to 50 degree-days.

The fuel requirements for December 25 in per cent. of the requirements for a normal season is (50 ÷ 7360) × 100 or 0.68%.

If a customer uses 50,000 cu. ft. of gas in a month during which the fuel requirements were 20% of the requirements for a normal season, it naturally follows that the gas consumption for the normal season will be 5 times the 50,000 cu. ft. or 250,000 cu. ft.

Similarly, if on the December 25, mentioned above, a customer had used 2,000 cu. ft. of gas, the total consumption for the season would then be

$$2000 \times \frac{100}{0.68} \text{ or } 294{,}000 \text{ cu. ft.}$$

The following table gives the per cent. of the season's fuel requirement, corresponding to the average temperature for a day, based on a heating season of 7360 degree-days.

| Outside Temperature Deg. F. | Per Cent. Per Day | Outside Temperature Deg. F. | Per Cent. Per Day |
|---|---|---|---|
| 70 | 0.00 | 29 | 0.56 |
| 69 | .01 | 28 | .57 |
| 68 | .03 | 27 | .58 |
| 67 | .04 | 26 | .60 |
| 66 | .05 | 25 | .61 |
| 65 | .07 | 24 | .63 |
| 64 | .08 | 23 | .64 |
| 63 | .10 | 22 | .65 |
| 62 | .11 | 21 | .67 |
| 61 | .12 | 20 | .68 |
| 60 | .14 | 19 | .69 |
| 59 | .15 | 18 | .71 |
| 58 | .16 | 17 | .72 |
| 57 | .18 | 16 | .73 |
| 56 | .19 | 15 | .75 |
| 55 | .20 | 14 | .76 |
| 54 | .22 | 13 | .77 |
| 53 | .23 | 12 | .79 |
| 52 | .24 | 11 | .80 |
| 51 | .26 | 10 | .82 |
| 50 | .27 | 9 | .83 |
| 49 | .29 | 8 | .84 |
| 48 | .30 | 7 | .86 |
| 47 | .31 | 6 | .87 |
| 46 | .33 | 5 | .88 |
| 45 | .34 | 4 | .90 |
| 44 | .35 | 3 | .91 |
| 43 | .37 | 2 | .92 |
| 42 | .38 | 1 | .94 |
| 41 | .39 | 0 | .95 |
| 40 | .41 | —1 | .96 |
| 39 | .42 | —2 | .98 |
| 38 | .43 | —3 | .99 |
| 37 | .45 | —4 | 1.01 |
| 36 | .46 | —5 | 1.02 |
| 35 | .48 | —6 | 1.03 |
| 34 | .49 | —7 | 1.05 |
| 33 | .50 | —8 | 1.06 |
| 32 | .52 | —9 | 1.07 |
| 31 | .53 | —10 | 1.09 |
| 30 | .54 | | |

**By means of this table it is a simple matter to note the average temperature for any day, and find the percentage of a normal season's fuel requirements which would be used on that day.**

### CALCULATION OF ANNUAL CONSUMPTION FROM MONTHLY BILL

**Suppose for example, we are discussing a heating bill for the gas consumed from December 18, 1924, to January 18, 1925, and that 85,000 cu. ft. of gas were consumed during this period. Referring to the tabulation of the daily percentages of a normal season's fuel requirements represented by each day, we find in the fourth column of the December 1924 record that the percentage factor from the 18th to the end of the month was 11.77%. Similarly, in the third column of the January, 1925, record, we find that the percentage factor from the first, up to and including the 17th of the month, is 10.76%. The total factor, then, from December 18, 1924, to January 18, 1925, is 22.53%. Since the gas consumed during this period was 85,000 cu. ft., the expected annual consumption will be**

$$85{,}000 \times \frac{100}{22.53} \text{ or approximately } 378{,}000 \text{ cu. ft.}$$

### COLD WEATHER FIGURES ARE MOST RELIABLE

**The early fall and late spring bills do not always give accurate results with this method. This inaccuracy undoubtedly is due to the variation in the ventilation and temperature requirements of the users during mild weather.**

**The season's estimates obtained from gas consumptions occurring during cold weather are quite accurate, in spite of the fact that no correction is made for the effects of sunshine and wind velocity.**

### COST OF CARRYING TEMPERATURES OVER 70°

**One of the common causes for unanticipated fuel consumption in heating homes, is that temperatures higher than 70° occasionally are maintained.**

**The average outside temperature during the heating season for Chicago is 38.0°. The average temperature difference, as mentioned before, is 32.0°. Since heat losses from buildings are directly proportional to the temperature difference between the inside and outside of the home, an increase in temperature difference of one degree will cause an increase in fuel requirements of about 3.1%. If a customer carries 75° instead of 70° the cost will be increased by about 15.5%. Similarly, a temperature of 80° in the home will cause an increase in fuel consumption of about 31%.**

### ESTIMATING MONTHLY BILLS IN LETTERS

**When a customer writes a letter of complaint on a high bill, we find it a most satisfactory practice estimating the total season's consumption in preparing a reply, and to outline the probable monthly gas bills for the remainder of the heating season. This method gives the customer the opportunity of studying the situation quite thoroughly, and also gives him an outline of what to expect in the future. Another feature is that the customer is assured that his bills are in accordance with the estimate.**

# University of Wisconsin Infiltration Tests

Some idea of the scope of the air infiltration test, to be conducted by the University of Wisconsin, in co-operation with the A.S.H. & V.E. Research Laboratory, is given in the accompanying views of the testing apparatus as set up at the university. Plans for the test embrace not only air leakage through windows, but infiltration through various types of building construction.

**Set-Up for Infiltration Tests at University of Wisconsin**

**Wall and Window Frame in Place in Testing Apparatus**

Careful consideration has been given to the questions raised over the methods followed by the A.S.H. & V.E. Research Laboratory in making its air infiltration tests and it is expected that the new data to be procured will find a general acceptance throughout the industry.

# Legal Decisions

## Action for Preparing Plans and Specifications for Heating System

In an action by a salesman against a board of education for the value of plans and specifications which, he alleged, were prepared and furnished by him to the board, at its instance and request, to be used in the alteration of a school building and in installing a heating and ventilating system therein, it appeared, from the testimony, that the plaintiff appeared before the board and exhibited samples of his system of heating, with a view of inducing the board to install it, but, that the board did not request him to prepare plans and specifications; that later, a member asked him to draw up such plans and specifications, which he agreed to do without charge, if his system should be installed. The member used a part of these in submitting plans and specifications to the board, which selected another system of heating and directed the plans to be modified accordingly, so that plaintiff's drawings were not used nor was his system installed. There was no evidence of any agreement or understanding with the board, or with any one on its behalf, that, in the event plaintiff's drawings were not used, he was to be paid for them. It was held, *Spencer* v. *Board of Education*, of Murray City, Utah, Supreme Court, 250 Pac. 392, that there was a want of evidence to support plaintiff's allegations, that he prepared or furnished any kind of plans, drawings or specifications, at the instance or request of the board, or that his plans were used by the board in installing the heating system which was installed; and judgment for plaintiff was reversed and a new trial ordered.

## Award of Contract for Heating System Sustained

In proceedings by a taxpayer to review an award to the lowest bidder of a contract for $509,000 for a heating system in the convention hall at Atlantic City, and to have the contract awarded to the next highest bidder for $510,812, the New Jersey Supreme Court, Smith v. Board of Commissioners of Atlantic City, 136 Atl. 607, confirmed the award to the lowest bidder for the following reasons:

"First. We are unwilling to set aside the award of the contract, in this case to Riggs, Distler & Co. for $509,000, on the sole ground that the specifications invite 'alternative bids.' Our research has revealed no case in which this point has been directly considered.

"Second. We can find no evidence that the specifications have been unfairly manipulated in favor of the contractors to whom the award has been made.

"Third. The addendum provides: Nos. 3 (2) 'Under the vacuum heating system necessary apparatus, specialties and valves, as manufactured by Dunham Company, Barnes & Jones, or other approved standard makes, shall be considered as equal to Warren Webster & Company specialties, valves, traps,' etc. Under this clause $3,000 was deducted from the Riggs, Distler & Co. bid of $512,000, thus reducing the bid to $509,000, making it the lowest bid, and next to that of John H. Cooney of $510,812, to which $2,000 was to be added if the Warren Webster specialties were adopted.

## Time for Filing Mechanic's Lien for Furnace Replacing One Unauthorized by Building Code

A mechanic's lien was filed under the Oregon statute on a dwelling house in the city of Portland, arising out of a contract made by the corporation filing it with the owner of the house, for furnishing and installing a furnace, "together with all necessary pipes and equipment to make a complete warm-air heating system." Thereafter the corporation brought suit to foreclose the lien. The trial court dismissed the complaint, and the corporation appealed.

The Oregon Mechanics' Lien statute, Or. L., Sec. 10195, provides that every original contractor who claims the benefit of the statute shall file his claim for such lien within 60 days after the completion of his contract. It was necessary, therefore, for the decision of the case, to determine the date of the completion of the contract. At the time of making the contract the plaintiff had in stock furnaces which failed to comply with the requirements of the building code of the city of Portland, and knowingly installed one of these furnaces in the dwelling house; the work of installation being completed on or about April 4, 1925. A representative of the building department of the city inspected the furnace, and on April 22, 1925, notified the company that it must replace it. The owner of the house gave a like notice. On May 2, 1925, the company removed the furnace as requested, and replaced it with one meeting the requirements of the building code and the owner's demands. The defendants (the owner and the representatives of the person to whom the building had been transferred after its construction but prior to the filing of the lien) claimed that the date upon which the statutory period for filing the lien began to run was April 4, 1925, the date the original furnace was installed; whereas the plaintiff contended that the lien was filed within the statutory period, for the reason that the statutory time commenced to run on May 2, 1925, the date of the installation of the second furnace.

The Oregon Supreme Court, Stark-Davis Co. v. Wilson, 248 Pac. 1095, said that in that jurisdiction it is settled that a contractor cannot keep alive his right to a lien by performing a trifling

amount of labor after the contract has been considered by all parties as completed; and that, where rights of an innocent grantee are involved, trifling things should not be considered as incident to the completion of a contract. But when a material and substantial thing required by the terms of the original contract has been omitted, the final completion of the contract dates from the time such omission is supplied by the contractor. The court said:

"In the case at bar, more than six hours of skilled labor was performed and a new furnace of the value of about $90 was supplied on May 2, 1925; this labor and material amounting to more than one-half of the contract price. The heating plant has never been paid for. The fact that the plaintiff attempted to install, and in the first instance did install, a furnace that had been constructed of lighter material than that required by the building code of the city of Portland does not deprive it of its right to compensation for a lawfully constructed furnace and labor supplied on demand at a later date."

The decree of the lower court was set aside, and one entered in favor of the plaintiff in accordance with the prayer of the complaint, except that, on account of the plaintiff's delinquency in installing the unauthorized furnace, neither party was allowed to recover the costs of the appeal.

# Overproduction of Oil and Lowered Freight Rates Augur Well for Oil-Burner Industry

AN alarming overproduction of crude oils in the United States, reaching a peak during the week of May 2-7, when all previous productions were smashed with a daily average of more then 2,500,000 barrels, has thrown the oil industry into an almost uncontrollable chaos. On top of this the announcement of material reductions in freight rates, effective May 20, adds joy to those interested in the sale of oil-burning equipment and gloom to the coal industry.

With the balance of relative costs such that an efficient domestic heating plant burning oil can be operated at substantially the same cost as with coal, and with the fact established that the homeowner is willing to pay, on an average, twice as much for oil as for coal, the reduction in the price of oil fuels that already has been made, since early in the period of overproduction, with possibilities of further cuts, indicates a tremendous boom in oil-burner sales.

Overproduction centers in the Seminole fields in Oklahoma where the output has jumped from 100,000 bbls. a day in November to nearly four times that amount in May. The result has been a drop of 50% in the price of crudes in that section. It would appear that this condition has been brought about by the drilling of independents, rather than through production from properties of the big companies. The former group claims that there is nothing wrong in increasing production and that the "trust" does not want to see retail prices reduced. The representatives of the larger organizations claim that continued production at the present rate will result in retail prices being reached that will be below production costs.

Conferences were held during the week of May 9-14, at the invitation of Walter C. Teagle, president of the Standard Oil Company of New Jersey, at 26 Broadway, New York, at which it was attempted to work out plans to end the chaotic condition. Secretary Work, of the Department of the Interior, was appealed to by Mr. Teagle with the request that a restriction plan to prevent overproduction be sponsored by the Federal government.

There is no question as to the instability in the oil industry due to the unrestricted production that obtains. If a well of exceptional yield is brought in by a so-called "wild-catter" or if, as has happened in the Seminole district, a large number of independent wells materially increase production at a period when the demand is steady, it means that storage facilities are quickly exceeded and prices sag dangerously. Where a large field is exploited without control it becomes a question of "the devil take the hindmost" and each "wildcatter" strives to get the oil out of the ground before it is drawn off through the wells of his neighbors.

Speaking for the Federal Oil Board, Secretary Work said:

"The present plight of the industry is recognized fully by this board, and I feel that the leaders in the oil world realize that the government is ready and willing to assist in every proper manner to meet the crisis. There are certain Federal statutes which, of course, govern as well as the police laws of the several states and other local acts and regulations, which cannot with impunity be brushed aside, even in an emergency. But the Federal Oil Board will be glad to counsel and advise with the industry and do everything within reason and the scope of the law to assist."

The Interior secretary also pointed out that during the board's study of the oil situation last year "certain elements in the oil world" insisted there was no danger of overproduction. The board, he said, nevertheless worked out certain suggestions which the greater portion of the industry readily accepted.

Editor's Note: Since the above was written, all but two of the important oil producers in the great Seminole field of Oklahoma, which at the present time is producing over 14% of the nation's crude oil, met in New York and bound themselves to limit their production for an indefinite period in an effort to avert a disastrous price condition in the industry. Walter C. Teagle, president of the Standard Oil Company of New Jersey, acted as chairman of the meeting.

Ray H. Collins, an independent operator from Tulsa, Okla., who has served as an umpire in the Seminole area since the condition became alarming, will be continued, by unanimous vote, in this capacity and virtually will be a czar in the oil-production industry in Oklahoma until the abrogation of the agreement through the withdrawal of more than a majority of the twenty signatory companies. The Gulf Oil Corporation and the Cities Service Company, both heavily interested in the Seminole field, declined to sign the agreement.

It is indicated by the report of Mr. Collins that restricted drilling, especially around the edges of the developed Seminole area, will probably result in a reduction in the rate of production from this area and will quickly reduce the enormous surplus stocks now on hand.

According to the Collins report "there is a general feeling among the Seminole operators that the condition of overproduction, now existing in the industry, is due as much to the west Texas and California field as it is to the Seminole. At any rate, the potential production in west Texas is as much a menace to the industry as Seminole."

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## Marr Exhibit at Oil Burner Convention

Due to the fact that contract for space at the recent oil burner convention exhibition was not signed by the Marr Oil Heat Machine Corporation until after the April issue of THE HEATING AND VENTILATING MAGAZINE had gone to press, the name of this manufacturer did not appear in the list of exhibitors appearing in the April issue. This list being used as a base in checking off exhibitors at the convention, a description of the exhibit inadvertently was omitted from the convention report number.

As a matter of fact the Marr exhibit was very much in evidence and attracted no small amount of attention, largely because of the exhibit of the new Marco burner which is being marketed by this organization to meet the increasing demand for small and simplified burners for water heaters and small residence work. In addition, two of the regular size and type machines were shown. The Marr organization was represented at the convention by Earl Marr, president, L. W. Place, vice-president, George V. Fletcher, N. W. Bowen, J. W. Rothenberger, R. K. Lindsay and Homer Waltermyre.

# Correspondence

*Conducted by T. W. Reynolds*

## Boiler Overload When Starting Up a Heating System

EDITOR HEATING AND VENTILATING MAGAZINE:

H. L. Alt's interesting article in your April issue gives much valuable information on the load on a boiler during the heating up of a system. However, it might be interesting to give further consideration to the overload that would be put on the boiler by a system designed to heat up quickly. In this case, due consideration must be given to the greatly increased rate of condensation when steam is first admitted to a cold radiator (provided the air can be expelled quickly) and the increased heat emission of about 20%, due to the radiator being in a room at 50° F. instead of 70° F., both of which have a material effect on the load of the boiler.

To look at this side of the problem, assume the same radiators and arrangement of piping described by Mr. Alt, with added provision that supply valves and thermostatic traps of ample size are installed on each radiator and that the return line is of ample size and properly vented through an efficient air eliminator. Then further assume that these radiators are located in rooms that are used intermittently and only heated when used, but that the steam is supplied from boilers of ample capacity to supply steam to the system as fast as it will receive it and in which a steam pressure of 2 lbs. is constantly maintained.

Data published in the A.S.H. & V.E. Guide for 1925-1926 show that when steam is turned into a cold radiator it reaches its maximum condensation rate in about 10 minutes, this being about four times the normal rate. The condensation rate then decreases until at the end of 20 minutes the normal rate is reached. This is shown by the curve in Fig. 1.

Assume that the last of the 60 radiators reaches its maximum condensation rate 30 minutes after the steam is turned on (which corresponds to Mr. Alt's one-hour warming-up period) and this will mean that the first radiator is at its maximum condensation rate in 10 minutes and three more each minute until all are hot.

The load on the boilers for one radiator under this condition is shown by curve No. 1, Fig. 2. The total load from the radiators on the boilers will be the summation of 60 of these curves starting at 1/3-minute intervals and is shown by curve No. 2, Fig. 2.

Assuming the load due to the radiation from the piping as 25% of the load due to the radiators, and that it reaches its maximum value in 10 minutes, the total load on the boilers from the pipe and radiators will be as shown by curve No. 3, Fig. 2.

Now, at the end of 40 minutes the radiators and piping will be thoroughly heated, but the room in which the radiation is placed will not much more than have started to heat and it will probably be at least 50 minutes more before an even temperature of 70° F. is reached. This will mean that after first being heated the radiators will give off about 20% more heat than is shown in curve No. 2, Fig. 2, on account of being in a room at 50° instead of 70°. This is shown by curve No. 2A, Fig. 2. Curve No. 3A, Fig. 2, shows the combined pipe and radiation load during the heating-up period.

These curves demonstrate that a properly-piped and vented system can put a material overload, up to 100%, on the boiler during the time it is heating up and if no overload is to be put on the boiler the time taken to heat up must be materially increased.

The writer knows of two office buildings in which the boilers when forced can supply but little more steam than is required to keep the building warm in severe winter weather. In both of these it often takes from five to ten hours to heat the building up to normal temperature, after it has been allowed to cool down over a holiday. Such conditions are very annoying to both owners and tenants and it therefore seems advisable, in most cases at least, to install boilers that have some overload capacity.

WILLIAM W. GAYLORD.
New Haven, Conn.

It is gratifying to receive such a concise and intelligent communication concerning the subject of boiler overload, showing as it does that our correspondent has given some careful thought to this problem. Of course, in assuming an installation for the basis of calculation, it was necessary to select a set of conditions which would simplify computation to the greatest possible extent. No assumed scheme of piping possibly could cover all the multitude of variations which ordinarily occur. Another arrangement of radiator or piping naturally would affect the results which might then work out either higher or lower than the figures shown.

It was endeavored in the example cited to take as fair an average a set of conditions as possible, with the idea of showing just what the figures ordinarily would indicate. It will be noticed, in the case cited, that the calculations themselves showed a boiler overload of 54%, when all radiators were heated in 60 min. It was only when the warming-up period was extended to 90 min. that the overload disappeared.

The only point which it is desired to mention in regard to the curves pre-

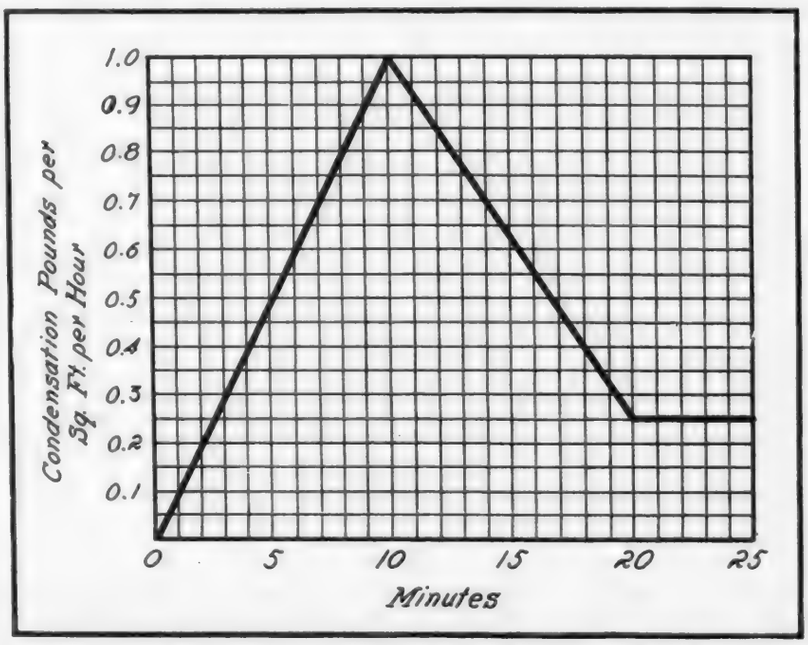


**Fig. 1. Rate of Condensation in Warming Up a Steam Radiator**

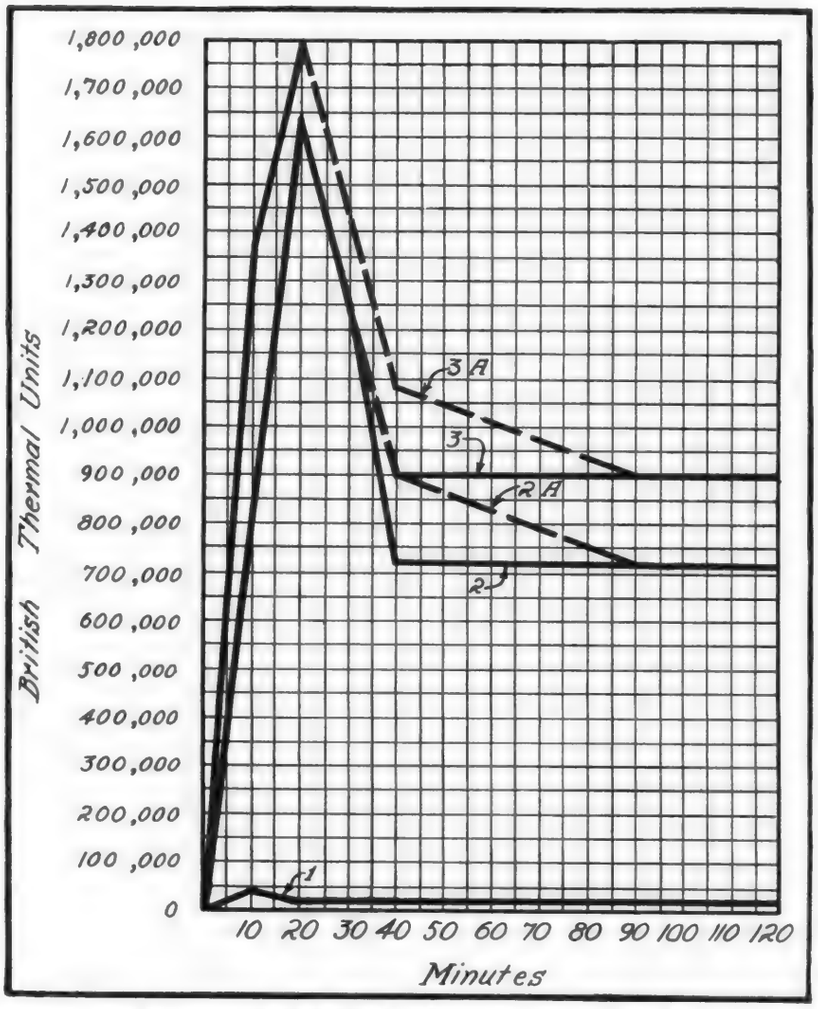


**Fig. 2. Analysis of Boiler Load During Heating-Up Period**

sented by our correspondent is that they are all based on the curve developed from a single radiator. While this radiator under test doubtless has an ample and sufficient supply of steam furnished to it, else the test would have been valueless, the fact remains that in warming up a heating system, there is not an adequate supply of steam until the last radiator is heated, or, in other words, until the calculations have been concluded.

Such an insufficient supply of steam results in the radiators heating more slowly than otherwise and, therefore, the extreme point of the peak on the curve submitted by our correspondent will not actually be attained in practice.

This subject has nothing to do with the slowness of buildings to heat up after being allowed to become cold, unless this slowness is caused by cold radiators. If the radiators are all heated thoroughly in a reasonable length of time, no amount of increase in the boiler capacity, or rating, will remedy the situation, as the fault lies with inadequate radiation and not inadequate steam. Nearly all heating text books contain percentages to be added to normal amounts of radiation to meet just such conditions, but when the necessary allowances are not made, the annoying conditions described by our correspondent will occur, and they are very exasperating, just as he says.

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## Greasy Core Sand in Radiators as a Cause of Boiler Foaming

EDITOR HEATING AND VENTILATING MAGAZINE:

Referring to the inquiry in your February issue as to why the water leaves the boiler, I quite agree that the trouble probably is caused by foaming due to dirt in the water, but I think that probably one of the most prevalent sources of this condition is generally overlooked.

I have been having a great deal of trouble with a new vacuum installation. The amount of dirt taken from the traps and pump strainer clearly indicated that it was coming down from the system, and, as usual, carelessness on the part of the steam fitter was suspected until one day two radiator sections cracked and had to be replaced.

These were of the new thin leg type, and if all the other radiator sections in the building have as much greasy core sand in them as these two had, we shall be lucky if we get the system clear within the next two years.

A steam heating contractor recently told me that he had an installation with standard column radiation which he had been washing out for the last eighteen months and it is not right yet. His observations convinced him that the whole trouble was caused by oil and dirt in the radiators.

It seems to me that this is a matter which might well receive further investigation, for surely the wail of the contractor is heard in the land, and some of the hard luck tales which one hears would be almost unbelievable if the story were not so common.

Of course we all know that boilers are often shipped onto the job in a dirty condition, but getting grease out of a boiler is easy, compared with getting it out of the radiators.

Newark, N. J. J. O. G. GIBBONS

Core sand in the radiators can do no harm if it stays there. For example, the slight depression which exists at the bottom of each radiator section tends to retain much of the deposit and to prevent it from working down into the boiler. Scale pockets also are of help in this connection. In any event, it is far less troublesome to clean out the boiler several times until the sand stops coming than it is to clean out the radiators and piping.

The best method to use in order to lessen this trouble is to specify that the manufacturer sandblast and pickle the radiation inside before shipment. This will add a few cents to the cost per square foot of radiation. Of course, the radiators and piping must also be covered while lying about on the job and not be left piled against heaps of sand, or otherwise left unprotected. Such methods will eliminate most of the trouble, but not all of it, nor will they prevent the troubles arising in the boiler due to water which originally is dirty.

Troubles as pointed out by the correspondent were covered in general by an article appearing in THE HEATING AND VENTILATING MAGAZINE for November, 1924, Page 69, entitled "Why Priming and Foaming Occur in Heating Systems More Often Than Formerly." Summarizing the remarks made in the article referred to, it may be pointed out that the troubles are increased due to the dipping of the pipe in crude oil to preserve it and to the use by the manufacturers of a binder of fish oil for their core sand. This oil makes the sand adhere longer. Consequently, a boiler may be cleaned out, yet the core sand will keep coming and numerous cleanings are required before conditions are finally satisfactory. Then comes the pipe fitter who finds it easier to swab the female end of a pipe than to go around the male end and far easier to pick up an ell or other fitting than to pick up a length of pipe. He is content to dip a paint brush in the pail, not

even taking the trouble to wipe the brush off on the side of the pail before applying the paint.

Obviously, the above conditions can be prevented, that is, technically, by prohibiting them in the specifications, as can also the general lack of reaming the pipes; but to have the letter of the contract carried out on the job is a difficult thing in these days, even when the contractor's foreman is diligently watching the job.

# Notes on Design of Residence Heating Systems

EDITOR HEATING AND VENTILATING MAGAZINE:

I would appreciate a discussion on the main points of design which should be kept in mind in residence heating by steam. For example, what temperatures are required in the various rooms?

Dayton, O. A. L. B.

The amount of radiation in bathrooms of residences is usually made sufficient to maintain a temperature of 80° F. in these rooms, as well as to allow for the drying of towels with which the radiator may be covered. However, it is not so much a question of what temperatures are proper in each case as it is to have an excess amount of radiation for the purpose of heating quickly such rooms as are only used occasionally, as well as such other rooms as are allowed to cool off during the night, but which are the first to be used in the morning.

Visualizing these conditions one would want plenty of radiation in the bathroom, then ample radiation for quick heating in the breakfast room, for in this room the owner will expect to be comfortable. Of course, the master bedroom should be favored with more excess radiation than the other bedrooms which seldom may be used.

Aside from the above, the rooms downstairs should be favored somewhat as they constitute the living quarters. Use plenty of radiation in the vestibule, much more than figured, in order to take care of sudden drafts when the outside door is opened. Do the same for the inside hall, except that the excess amount of radiation need not be quite so great in this case as that provided for the vestibule.

### TYPE OF HEATING SYSTEM INSTALLED A FACTOR

In considering the amount of excess radiation which should be used in the various rooms, judgment also should be exercised according to the type of heating system installed. The more responsive the heating system is to quick circulation and the more ability it has to do a certain amount of heating while running with fires banked during the night or at other times, the less the excess amount of radiation that will be required. True vapor systems answer to these requirements, hence less excess radiation can be used with such systems.

An additional help in obtaining quick heating lies in the piping design. Circuits should be balanced for radiation load and length and mains should go first to the risers supplying northwesterly rooms, insofar as practical to do so.

Seldom can a piping layout be made which will fulfill all of these requirements, hence judgment is again required as to the best compromise. In any event, use large pipes to the points mentioned, drain these pipes well, and in ordinary gravity systems (at the end of mains where these drop wet), use only a type of quick-vent valve which requires an extremely low pressure to open, hence quickly frees the mains of air. Of course, if quick-vent valves are not used the air in the mains finally will be vented through the radiators, but the system will never be as responsive as it should be, especially when some of the radiators are shut off, thus making the ends of the mains quite slow in warming up.

### ADVANTAGE OF POSITIVE-ACTING FLOAT TRAPS

Positive-acting float traps are good things to use at the drip points of vapor systems, such as at a rise in the steam mains. Such traps are of great help in quickly relieving the mains of the large amount of condensation which accumulates rapidly during the time the system is heating up. In operation they are sensitive to water, rather than temperature. Furthermore, the discharge port of these traps opens wide, thus eliminating the destructive effect on the seat of wire drawing, as in a trap having a graduated action.

Of course, these traps, or any other type of trap, are not required where there is a wet return into which a main or riser may be dripped, and, in this connection, it is generally preferable to use wet returns wherever possible. Such returns also are of advantage wherever net headroom is too limited to allow for a dry return, or where basement radiators are installed which may be connected into this wet return. In addition to this, smaller pipes may be used in wet returns than in returns which are dry, because there is no steam or air in wet returns, hence they need only be of sufficient area for passing the condensation.

### HOW TO KEEP HEAT ON IN THE BATHROOM

It is a good plan to design the heating system so that heat will always be on in the bathroom regardless of the rest of the house. This requires that this room be heated independently of the house system which may operate off and on by temperature control, or in which steam may not circulate at times because of banked fires. In order to accomplish this it is necessary to connect the radiator to the circulation line of the domestic hot water service, thus helping out the circulation back to the hot water tank while heating the bathroom continuously. This, of course, presumes that the amount of bathroom radiation (usually but a few square feet) will be increased in proportion to the lower temperature of the domestic water service and that the hot water tank is well covered or connected to an auxiliary heater from the boiler so that the radiator will do a certain amount of heating all night.

Sometimes the method as described is objectionable, due to coloring of the hot water service from rust in the radiator. In such cases, one of the now familiar and much-used small indirect heaters can be connected below the water-line of the boiler and used for heating the garage and bathroom. In this case, the indirect heater system should be provided with an expansion tank, as it would have no connection with the domestic hot water service for relief of expansion.

There is a bit of psychology to be taken into account in connection with residence heating—do not show the radiators on the plans to scale. Somehow their true representative size seems to alarm the owner when he sees them. They seem to him to appear larger in proportion to the room than they really are, and, as a consequence, invariably he wants to reduce their size; whereas, if their actual size is not revealed by plan, the owner will seldom comment unfavorably when he sees them in their setting. Another good thing to remember is that the radiators should be no longer than the window, otherwise they may interfere with window draperies.

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## The Difference Between Conduit and Pipe

Conduit is merely used to cover and protect electric wiring from mechanical injury. It is not subject to any internal or external pressure, hence the weld is of comparatively small importance. It is necessary, however, that the bore be thoroughly smooth in order to avoid wearing away the insulation of the wire. For this reason, wherever standard pipe is to be used for conduit work it should be specified as "plugged and reamed." In this operation a plug or mandrel of the exact inside diameter of the pipe is forced through the pipe so as to remove any small irregularities. This is the main difference between ordinary pipe and conduit, except that a conduit is invariably furnished either galvanized or with an enamel coating.

# American Society of Heating and Ventilating Engineers

## Summer Meeting Program Replete with Important Committee Reports and Papers

FOR the forthcoming A.S.H. & V.E. meeting at White Sulphur Springs, June 27-30, a program has been prepared under the guidance of E. B. Langenberg that touches every activity into which the society has delved, and brings to a focus the labors of various committees for the last half-year.

The sessions will extend from 9:30 to 1:30 daily and the afternoons will be devoted to social and sporting activities which have been arranged by C. V. Haynes, in charge of entertainment, and R. C. Bolsinger, master of the golf tournament.

It is anticipated that over 400 will be present when the meeting is called to order by President F. Paul Anderson on Tuesday morning, and, on account of the reputation of the resort and the reports of fine roads leading thereto, many members are planning to drive down the famous Shenandoah Valley from the east and over the magnificent highway through West Virginia from the west. Special round-trip rates are available on all railroads and replace the reduced return-fare to certificate holders common to most conventions.

The meeting will be held at the Greenbrier Hotel where the entire delegation can be housed.

The tentative program is as follows:

MONDAY, JUNE 27

Registration.
Council Meeting.
Nominating Committee Meeting.

TUESDAY, JUNE 28

Registration.
Greeting by President F. Paul Anderson.
Discussion of code for heating and ventilation of garages, O. N. Walther, chairman, Philadelphia.
"Some Thoughts on Heating and Ventilation of Garages," E. K. Campbell, Kansas City.
"How Design and Operation of Heating Plant Compare in an Insulated Office Building," F. M. Holbrook, Lancaster, Pa.
Discussion of code for testing building insulation.
Report of Committee on Research, Samuel R. Lewis.
Report of Technical Advisory Committee on Heat Transmission, L. A. Harding, chairman, Buffalo.
Report of Committee for Rating Low-Pressure Heating Boilers, Alfred Kellogg, chairman, Boston.

WEDNESDAY, JUNE 29

Report of Guide Publication Committee, Perry West, chairman, Newark, N. J.
Report of Survey Committee, W. H. Driscoll, New York.
"Design of Gravity Extended Surface Heating Unit," R. N. Trane, La Crosse, Wis.
"How Radiator Performance Varies in Enclosures," A. P. Kratz and M. K. Fahnestock, Urbana, Ill.
Report of Technical Advisory Committee on Radiation, F. D. Mensing, chairman, Philadelphia.
"Study of Infiltration Around Windows," A. C. Armstrong, Baltimore.
Report of Technical Advisory Committee on Infiltration, Prof. A. C. Willard, Urbana, Ill.
Report of Technical Advisory Committee on Pipe Sizes, H. M. Hart, chairman, Chicago.
"Capacity of Up-feed Steam Heating Risers for One and Two-Pipe Systems" (Research Laboratory paper).
Report of Rochester Committee, Perry West, chairman, Newark.

THURSDAY, JUNE 30

Research Program at A.S.H.V.E. Laboratory by F. C. Houghten, director.
Report of Technical Advisory Committee on Temperature, Humidity and Air Motion, W. H. Carrier, chairman, Newark, N. J.
"Heat Transfer in Tubular Water Heaters," Mrs. O. E. Frank, Buffalo.
"Fundamentals of Heating and Ventilating Units," A. J. Nesbitt, Philadelphia.
"How Air Turbulence Influences Efficiency of Hot Blast Heaters," Prof. R. W. Angus, Toronto.
Discussion of Code for Testing Air Filters, Prof. F. B. Rowley, chairman, Minneapolis.

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## Window Leakage Test to be Made in St. Louis

Through the co-operation of the Southwestern Bell Telephone Co., St. Louis, arrangements have been made to conduct a test to determine window leakage and the effectiveness of weather stripping on the new telephone building. A row of windows on the eleventh floor on the north side of the building is equipped with modern double-hung steel windows. This floor was chosen because it is practically at the neutral zone in the building—the height point where inward pressure from the chimney effect of the building is about equal to the outward pressure always manifest in tall buildings from the same chimney effect.

Four manufacturers of weather-strip equipment have agreed to supply strips and see that they are properly installed. The test will not in any sense be competitive, but merely to determine the facts in the case—what the infiltration is and to what extent it can be reduced by the proper application of window strips. The outcome of the experimental work attached to this test will be looked forward to with a great deal of interest by the industry.

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## New Officers of Massachusetts Chapter

Officers of the Massachusetts Chapter, elected at its final meeting of the season, May 10, at the University Club, Boston, are: President, Davis S. Boyden, Boston Edison Company; secretary, J. W. Brinton, American Blower Company; treasurer, W. T. Smallman, Isaac Coffin Company. Board of governors: Davis S. Boyden, E. A. Dusossoit, E. C. Whitaker, Coll Flint, G. H. Gleason and Philip Drinker.

Concluding a successful season the chapter staged a dance at the University Club, which was enjoyed by fifty members and their wives. President Boyden, having been called away, the installation of officers was delayed until the next regular meeting. Alfred Kellogg presided as master of ceremonies and at the conclusion of the evening, a vote of appreciation was extended to Coll Flint and G. H. Gleason, who were responsible for the arrangements.

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## Dr. Charles W. Brabbee and Reuben N. Trane Guests of Philadelphia Chapter

One hundred and fifty members of the Philadelphia Chapter, with their friends, gathered on May 12 for the last regular meeting of the season, the speakers being Dr. Charles W. Brabbée, director of the Brabbée Laboratory of the American Radiator Company, and Reuben N. Trane, president of the Trane Company. Dr. Brabbée, with the aid of lantern slides, told his hearers of the experimental work he is carrying on to determine the efficiency of cast-iron radiation under various conditions of application.

Mr. Trane, on the other hand, discussed fin heating surface when used in conjunction with cabinet enclosures for use either for exposed installation, or for total enclosure behind the wall line. He outlined the use of such radiation where the cool air from the floor line enters the cabinet and, after passing over the heating surface, returns

to the room through a grille just above the breathing zone, and he presented some illuminating data regarding the increased effectiveness of radiation when used in this manner. The timeliness of the subject and the authoritativeness of the speakers resulted in a lengthy discussion on both subjects which lasted until nearly midnight, when a vote of appreciation was accorded the guests of honor.

## Pittsburgh has "Down-Town" Meeting

The Pittsburgh Chapter's experiment of holding meetings down-town instead of at the Bureau of Mines, which is located well out in the exclusive East End of the city, is proving successful in increasing the number attending, as there were forty-three present at the meeting held May 2 at the down-town Y. M. C. A.

A. J. Nesbitt, secretary of John J. Nesbitt, Inc., of Atlantic City, was the speaker of the evening. He talked on "Unit Ventilation in School Buildings." The meeting was characterized as the most successful of the year. A poll of members was made to determine who should attend the summer meeting at White Sulphur Springs, and nearly a dozen expressed their intention of being present. The chapter is planning either a picnic or golf tournament to be held in August.

## Western New York Chapter Discusses Steam Heating

The May meeting of the Western New York Chapter was held at the Hotel Buffalo, May 9, with two score members and guests present. It was decided to hold a dinner dance, in charge of the entertainment and program committee, in place of the June meeting.

President Jackson outlined the program for the semi-annual meeting at White Sulphur Springs, and urged as many as possible of the Buffalo members to attend the convention. C. A. Thinn of the C. A. Dunham Co., Chicago, presented a paper on Pressure Differences in Steam-Heating Systems and Their Bearing on Operation. Lantern slides were shown, giving data on a number of installations where heating was done with vacuum as low as 25-in. and temperatures as low as 133° F. Mr. Thinn brought out the advantages of low-pressure steam heating and indicated economies in fuel consumption from 25% to 30% by obviating the over-heating so common to hotels and apartment houses. A number of architects, by invitation, joined in the discussion that followed.

The meeting held April 4 was greatly livened by the presence of Dean F. Paul Anderson and the senior class of the school of engineering, University of Kentucky, on its annual inspection trip. Led by the college cheer leader, the sixty students went through the K. U. series and ended with a vociferous token of appreciation for their hosts.

Dean Anderson, in a characteristic talk, told the chapter of the joy derived from contact with these young men and of their keenness to become active and competent engineers.

The guest of the evening, G. E. Harcke, director of the Airco-Davis-Bournonville Welding Institute, presented an interesting moving-picture story of the use of oxygen in metal welding and cutting and demonstrated some of the physical characteristics of liquid air with the aid of a jug-full of this fluid.

## Illinois Chapter Has Golf Tournament and Dinner Dance

Fifty-one members and guests of the Illinois Chapter participated in the annual golf tournament at Glen Oaks Country Club, May 19.

On May 20 the annual dinner dance was held at the Stevens Hotel, Chicago. One hundred and thirty-five members and guests were in attendance. A brief after-dinner address was made by William H. Driscoll, and slides of the various players of the previous day's tournament were shown and described by C. E. Beery.

The dinner dance committee was comprised of L. L. Narowetz, Jr., chairman; Eugene Mathis and J. H. O'Brien.

## New York Chapter Enjoys Frolic

At the May meeting of the New York Chapter over 100 members and guests met at the Building Trades Club for the annual frolic which features the last meeting of each season. President Carpenter introduced the incoming president, Richard Wolff. The meeting was then turned over to Alfred Engle, chairman of the entertainment committee, and the rest of the evening was devoted to an excellent vaudeville program, at the conclusion of which the committee, consisting of Alfred Engle, C. A. Dornheim and Russell Donnelly, was given a rising vote of appreciation.

## Kansas City Chapter Elects Officers

Officers elected at the chapter's annual meeting, May 9, are: President, Linn W. Millis; vice-president, Herman C. Henrici; secretary, Frank W. Wise; treasurer, David Caleb. Board of governors: F. F. Doods, E. Jones and Carl Weiss.

At the April meeting E. K. Campbell was appointed representative and L. W. Millis alternate, to the national nominating committee.

## C. U. Williams Addresses Chicago Oil Burner Association

A most optimistic outlook for the oil-burner industry was portrayed by C. U. Williams, president of the Williams Oil-O-Matic Heating Corporation, at the regular monthly meeting of the Chicago Oil Burner Association, held May 10.

Mr. Williams expressed the belief that the oil industry has fully recognized the permanency of the oil-burner business as a market for oil, and that as an industry would give its whole co-operation from now on. He compared the number of wired homes in America with the number of wired homes in several European countries and the comparison revealed that there are less than fifty out of every hundred homes in America wired for electricity.

The increase in European production of oil, Mr. Williams said, would reduce the volume of imported oil and domestic oil refineries and distributors were looking to the oil-burner sales to contribute to the making up of the loss due to less exports. Insulation, he stated, was just as big an asset to the oil-burner industry in its selling activities as insulation is to the gas industry. Recognition of the oil-burner industry by all the large financial houses in America, he added, was further evidence of the confidence in, and the general acceptance of, the oil-burner industry.

Incorporation of the association, and publication of the association constitution, by-laws, membership list, ordinances and other information was arranged for at the meeting. The Publicity Committee announced that the five bill-boards of the association were to be changed in June, with a view of merchandising the association membership seal.

## New Oil Burner Dealers' Associations

Striking evidence of the progress of the oil-burner industry is furnished in the announcement of the formation of local dealers' organizations in the New York and Boston areas. In Boston, the organization has been formed as the Boston Oil Burner Associates, with B. L. Hallinan as president and Max Seltzer, secretary and treasurer.

In the New York area an organization representing a district directly north and east of greater New York has been named the Westchester Oil Burner Dealers' Association, with Vernon Holby, of New Rochelle, N. Y., as chairman. On Long Island an association known as the Oil Burner Dealers' Association of Long Island has been launched, J. L. Osborn being president, William Clurman, treasurer, and S. T. Young, Jr., secretary.

# Health and Ventilation

*By Peter H. Bryce, M. D.*

## 2. What House Occupants Must Do to Insure Normal Indoor Air

IN a previous article was indicated what constitutes a normal house atmosphere, concerning which every one should be informed, and especially those responsible for the health and comfort of the inmates of dwellings. It was there stated what we should insure, so far as possible, in our houses, offices and schools:

*First*: House atmospheres free from gaseous or other impurities from without.

*Second*: House temperatures with gentle movement of the air, suited to the occupations and mode of dress of the occupants.

*Third*: Means provided according to the season to supply to house air the proper humidity of 50% to 55% so long as artificial heating is used.

Such is the immediate and personal duty of every householder; but he has, besides, a wider part to perform as a member of his community. Whenever an individual has come to know what is implied by normal air, his knowledge should become a community asset and his influence extend beyond his own household.

Living in the country or some city suburb, the individual may seem only to have his own house problem to solve, but should he be a resident of town or city he should co-operate with others in matters benefiting his fellow citizens. These include good streets free from dust, a pure water supply, proper sewerage and garbage removal and uncontaminated air.

It is apparent that these amenities will be secured only gradually, since the towns of this continent, in almost all instances, simply have sprung up beside some sea-bay, lake or stream and have been developed in keeping with the general intelligence and progressive spirit of the community. To illustrate, the writer lives in a capital city where, just a hundred years ago, the first tree was cut. It is situated on a magnificent inland river, with its great waterfall, which for seventy-five years made lumbering the chief industry. The natural result was the pollution of the stream with sawdust and mill refuse and the consequent destruction of splendid fisheries. As the pine became scarce and lumber more valuable, the river pollution with sawdust ceased, only to be replaced at times by the irritating fumes from several large pulp mills. But now, in keeping with public opinion, the city has an official town-planner, whose special duty it is to study civic problems and to educate the people, not only in the matter of streets and public parks, but in passing zoning by-laws to create distinct business and manufacturing areas apart from residential districts.

**Peter Henderson Bryce, M.A., M.D., F.R.C.S. Edin.**

Dr. Bryce is a former president of the American Public Health Association. He is a fellow of the Society of Medical Officers of Health, of England. At one time he was chief medical officer of Ontario and later chief medical officer of immigration for Canada. Thus he has had unusual opportunities to observe the effect of different air conditions upon health. His present series of articles is drawn largely from his long experience as a health official.

Another duty is to educate public sentiment in securing an abatement of the nuisance due to the clouds of soft coal smoke from the railway engines in the central station and large business buildings in the business area.

But perhaps no local agency is doing as much to educate the public in this matter, so important to health and aesthetics, as the heating and ventilating from a central heating plant, hidden away under the cliff beside the Ottawa, of seven large government buildings having a cubic area space of 13,237,608 cu. ft. Practically smokeless furnaces, using soft coal screenings, distribute steam to a distance of one mile and are illustrating how scientific efficiency is wholly in keeping with financial economy.

No matter where a dwelling is located the problem of house-building, heating and ventilation always depends on the same physical principles. If the young householder has determined to build his own family dwelling, naturally he will take counsel with some architect and, if wise, with some heating and ventilating engineer—a quite distinct entity. Indeed, if he has become a student of health problems he will seek advice from the columns of THE HEATING AND VENTILATING MAGAZINE, which will gladly answer any inquiries.

### ADVANCES IN THE FIELD OF WALL CONSTRUCTION

Having fixed on his location and installed proper drainage, the householder must decide on what wall construction will be most enduring and economical in the matter of heating and ventilation. The advances in knowledge made in this question, even within the past twenty years, have been notable, and have resulted largely from the experience and teaching of refrigerating engineers. It is some fifteen years since, with some difficulty, a standing committee on cold storage was appointed in the American Public Health Association, where a generally profound ignorance of the physics of insulation existed, even when applied to the conservation of foods. The laws are the same in house-heating, since the retention of heat in a dwelling-house or that of cold in a cold storage warehouse depends upon the non-conducting quality of house-walls. In THE HEATING AND VENTILATING MAGAZINE for April are given the results of a series of experiments, showing how the problem may be solved of making non-conducting house-walls by means of dead-air spaces.

The following table shows the transmission of heat units per hour through 1-in. thickness of substance and a difference between inside and outside temperature of 100° F.

| Substance | Heat units transmitted per hour |
|---|---|
| Still air | 43 |
| Ground cork | 45 |
| Slag wool | 50 |
| Cypress (cross section) | 145 |
| Brick work | 216 |
| Glass | 270 |
| Still water | 335 |
| Stone | 700 |

To-day walls made of hollow bricks, hollow cinder blocks, hollow cement blocks or frame structure with cork filling, all covered with a magnesite stucco, are supplying conditions whereby, with double-windows, the necessary amount of house-heating as regards the retention of heat can be closely calculated. The economy possible in the saving of fuel is so great that probably no other factor in house-heating and ventilating in northern climates is so important.

When it is possible to have a dwelling so constructed that the drop in temperature per hour, on a zero night with the oil burner shut off, is only 1° F. during eight hours, it is apparent

that the problem of dealing with the house-air has been greatly simplified.

Having dealt with the several external factors which enter into our "Health and Ventilation" problem, we are in a position to discuss the internal or immediate heating and ventilation question.

*The next article will deal especially with the heating and ventilation of the dwelling house or home, where the major part of the population spends most of the twenty-four hours, and upon which the measure of healthfulness of the family most largely must be determined.*

## Death of Ira H. Woolson

Educational and engineering circles experienced a shock at the recent sudden death of Prof. Ira H. Woolson, whose prominence in college, professional and civic activities had long since gained him international repute. He died of an apoplectic stroke in Chicago, where he was to have spoken at a conference of building officials.

Professor Woolson was born in 1856. He graduated from the Columbia School of Mines in 1885. After serving on the New Jersey Geological Survey for two years he returned to Columbia as assistant in drawing.

In 1891 he became official testing engineer for fireproof materials in the university, and in the same year established the laboratories for that work. He remained at Columbia until 1910, when he was named official investigator of building materials for New York City. He had made the tests for fire resistance of structural materials for the city ever since then.

During 1910 he was appointed by the National Board of Fire Underwriters as its consulting engineer. In 1918 he served as a consulting engineer with the War Industries Board.

On invitation of Governor Alfred E. Smith, Professor Woolson made a survey with the State architect of all the State hospitals, and for this work received warm commendations.

For many years he was a member of the American Society of Mechanical Engineers and of the American Society for Testing Materials. In the latter society he was chairman of many committees.

Professor Woolson wrote much on building codes, his works being standard all over the country. He was the author of "Recommended Building Code," "Standard Ordinance for Chimney Construction," "Code of Suggestions for Construction and Fire Protection of Dwelling Houses" and "Code of Suggested Ordinances for Small Municipalities."

J. E. Edwards, senior member of J. E. Edwards & Son, Allentown, Pa., who died March 25, at the age of 62 years, had long specialized in heating, ventilating and power work. He received much of his training and professional experience as a sales engineer and manager of the engineering department of W. H. Taylor & Co., of Allentown. Among the important installations which he designed are the heating plants for Muhlenberg College, the National Silk Company, and the Givernaud Silk Company Mills in Allentown.

Martin D. Holmes, president of the M. D. Holmes & Sons Co., Worcester, Mass., who died at his home in that city, March 21, was one of the most widely known figures in the heating industry in Massachusetts. Mr. Holmes began his career in 1884 as a heating contractor with Braman & Dow, heating and plumbing contractors of Worcester. Later he was employed by O. S. Kendall & Co., also of Worcester. Mr. Holmes organized his own business in 1900, under the name of M. D. Holmes & Sons. In 1909 the firm was incorporated under the present name, Mr. Holmes and his four sons holding the entire stock of the corporaton.

# Picking the Right Boys for Engineering Training

*By Alfred D. Flinn*

Director of Engineering Foundation

Inquiry has shown that many youths who should make winners in engineering and industry get lost somewhere between grammar school and college. On the other hand, a lot of young fry, who do not belong there, get into the net that lands them in the engineering colleges. After sorry waste of their time and father's money, and of educational resources, they find themselves on the "mortality" list or make but partial success as misfits.

One of the first steps toward better training for useful careers in industry and engineering, therefore, is to interest the right boys and to pick them out of the multitudes seeking admission to colleges and trade schools. Other improvements also in our system of engineering education have been found desirable by a three-year investigation recently completed by the Society for Promotion of Engineering Education, with the co-operation of more than a hundred engineering colleges, the engineering societies, the Carnegie Corporation of New York, the U. S. Bureau of Education, the National Industrial Conference Board, and a number of industries.

Now, the Society for Promotion of Engineering Education, with the support of the colleges, the American Societies of Civil, Mining and Metallurgical, Mechanical, and Electrical Engineers, Engineering Foundation, the engineering press, and numerous industries and individuals, has entered upon two years of further active endeavor to put its gathered facts into use.

Some of the objectives, very briefly stated, are:

1. Better admission, teaching and placement methods, and reduction of costly "mortality" in engineering colleges.
2. Broader and simpler curricula, with more emphasis on principles and on economic aspects of engineering.
3. Better provision for attracting and training men competent to be teachers.
4. Better adjustment between college education and industrial experience.
5. Improved means for training in specialties and business practices after graduation.
6. Closer bonds between colleges, engineering societies and industries.
7. Better balance of facilities, for vocational education, technical education, and professional education in engineering.
8. Economies of human effort and of funds, resulting from these betterments.

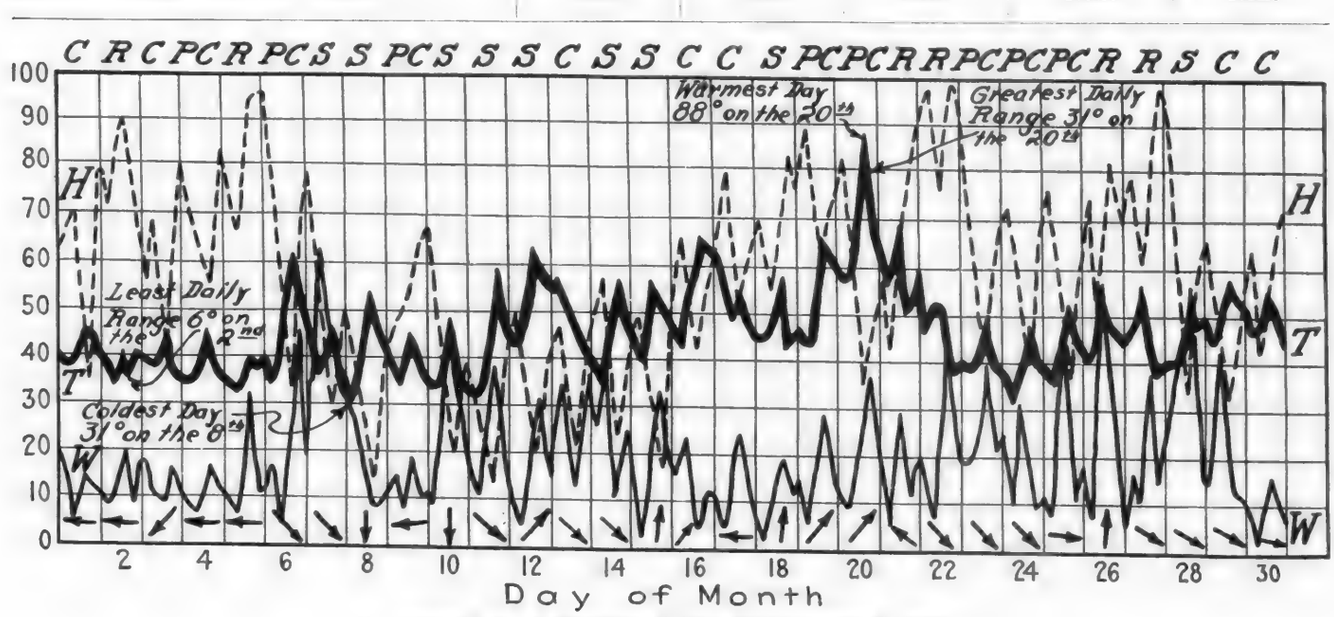
The special work is being done with the intention of terminating it in two years. The estimated cost is $100,000. The engineering societies and Engineering Foundation are contributing 12 per cent. The Carnegie Corporation of New York paid the bills for the three-year investigation, totaling $118,000. Industry, the largest immediate beneficiary, is being asked to supply the remainder.

The same small group that successfully carried through the investigation is going forward in the application of the facts collected. Dean O. M. Leland, M. Am. Soc. C. E., University of Minnesota, is president of the Society for Promotion of Engineering Education. Prof. Charles F. Scott, past-president, American Institute of Electrical Engineers, Yale University, is chairman of the Board of Investigation and Coordination, of which the other members are F. L. Bishop, secretary, M. E. Cooley, D. C. Jackson, D. S. Kimball, F. E. Turneaure, Frank Aydelotte, C. E. Seashore and O. M. Leland. Dr. W. E. Wickenden, M. American Institute of Electrical Engineers, is the director, and Prof. H. P. Hammond, M. Am. Soc. C. E., is the associate director of the project.

Further information, including reports of the investigation, will be supplied upon request addressed to Chairman Scott, Director Wickenden, or Engineering Foundation, at Engineering Societies Building, 29 West 39th Street, New York.

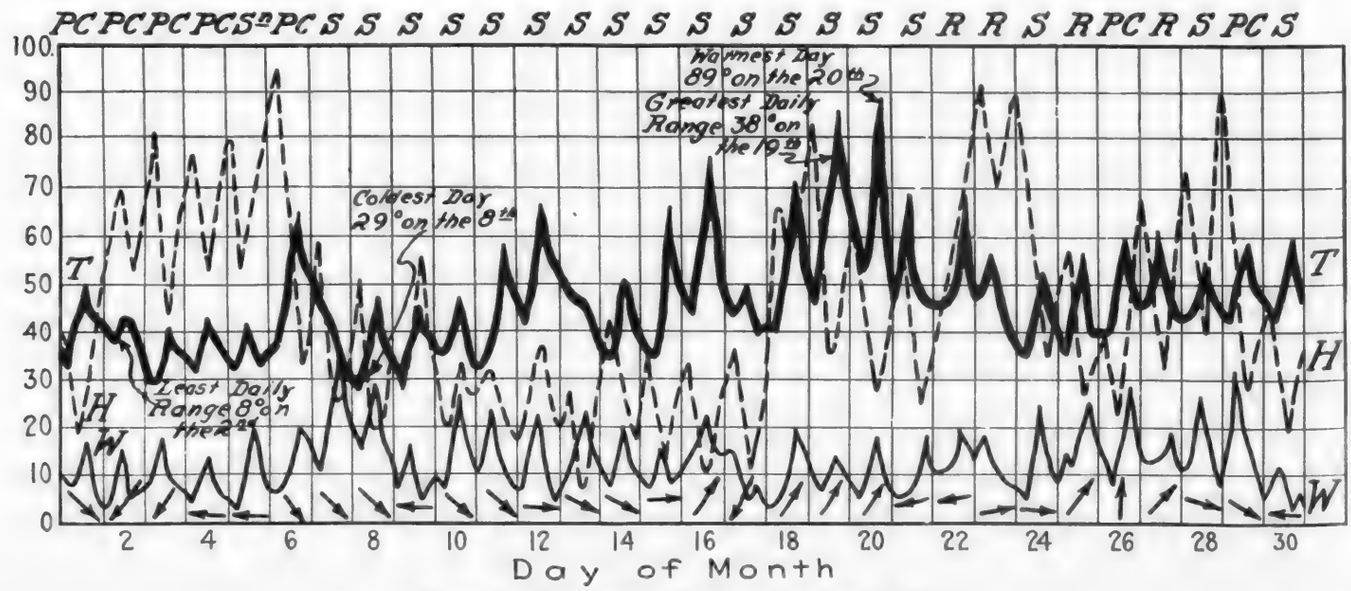
# The Weather for April, 1927

| | New York | Boston | Pittsburgh | Chicago | St. Louis |
|---|---|---|---|---|---|
| Highest temperature, deg. F | 88 | 89 | 83 | 79 | 82 |
| Date of highest temperature | 20 | 20 | 19 | 17 | 28 |
| Lowest temperature, deg. F | 31 | 29 | 30 | 31 | 34 |
| Date of lowest temperature | 8 | 8 | 23 | 22 | 22 |
| Greatest daily range, deg. F | 31 | 38 | 33 | 28 | 28 |
| Date of greatest daily range | 20 | 19 | 12 | 15 | 4 |
| Least daily range, deg. F | 6 | 8 | 6 | 5 | 5 |
| Date of least daily range | 2 | 2 | 3 | 2 | 11 |
| Mean temperature for month, deg. F | 47.7 | 48.3 | 49.9 | 47.8 | 57.0 |
| Normal mean temp. for month, deg. F | 49.4 | 46.4 | 51.3 | 46.9 | 56.1 |
| Total precipitation, this month, in | 2.66 | 1.36 | 3.15 | 60.1 | 6.30 |
| Total snowfall, this month, in | 0.2 | 0.2 | Trace | 0.5 | Trace |
| Normal precipitation, this month, in | 3.30 | 3.55 | 2.90 | 2.88 | 3.52 |
| Total wind movement, this month, miles | 12959 | 7626 | 8631 | 10078 | 9975 |
| Average hourly wind velocity, miles | 18.0 | 10.7 | 12.0 | 14.0 | 13.9 |
| Prevailing direction of wind | N.W. | N.W. | N.W. | N.E. | E. |
| Number of clear days | 8 | 16 | 3 | 14.0 | 9 |
| Number of partly cloudy days | 10 | 12 | 7 | 5 | 4 |
| Number of cloudy days | 12 | 2 | 20 | 20 | 17 |
| Number of days with precipitation | 8 | 8 | 14 | 18 | 14 |
| Number of days with snow | One | One | One | 2 | One |
| Snow on ground at end of month, in | None | None | None | None | None |

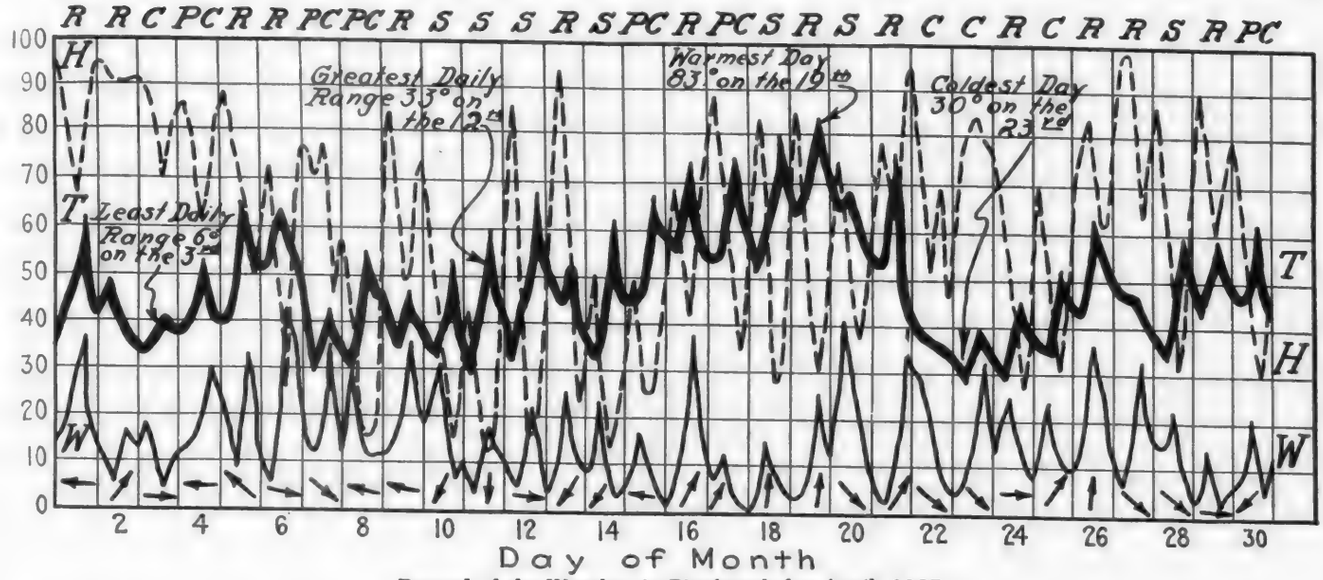

C R C P C R P C S S P C S S S C S S C C S P C P C R R P C P C P C R R S C C
Warmest Day 88° on the 20th
Greatest Daily Range 31° on the 20th
Least Daily Range 6° on the 2nd
Coldest Day 31° on the 8th
H
T
W
Day of Month

**Record of the Weather in New York for April, 1927**

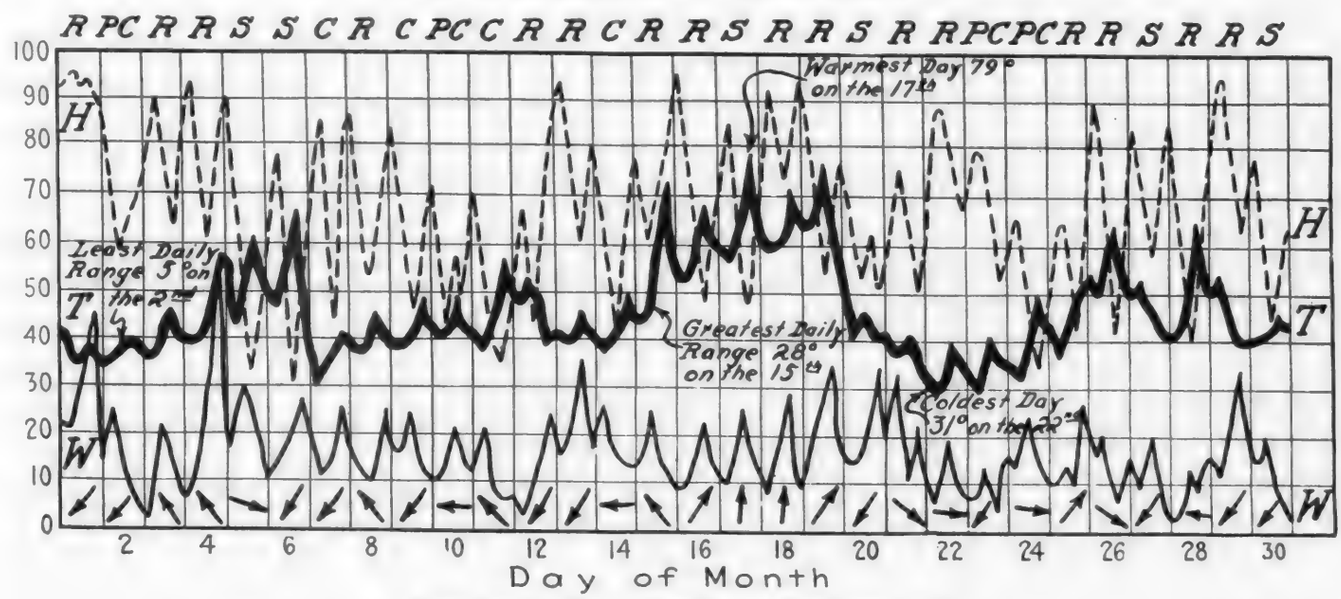
(Hourly Observations of the Relative Humidity Plotted on this Chart)


P C P C P C P C S2D P C S S S S S S S S S S S S S S S S S S R R S R P C R S P C S
Warmest Day 89° on the 20th
Greatest Daily Range 38° on the 19th
Coldest Day 29° on the 8th
Least Daily Range 8° on the 2nd
T
H
W
Day of Month

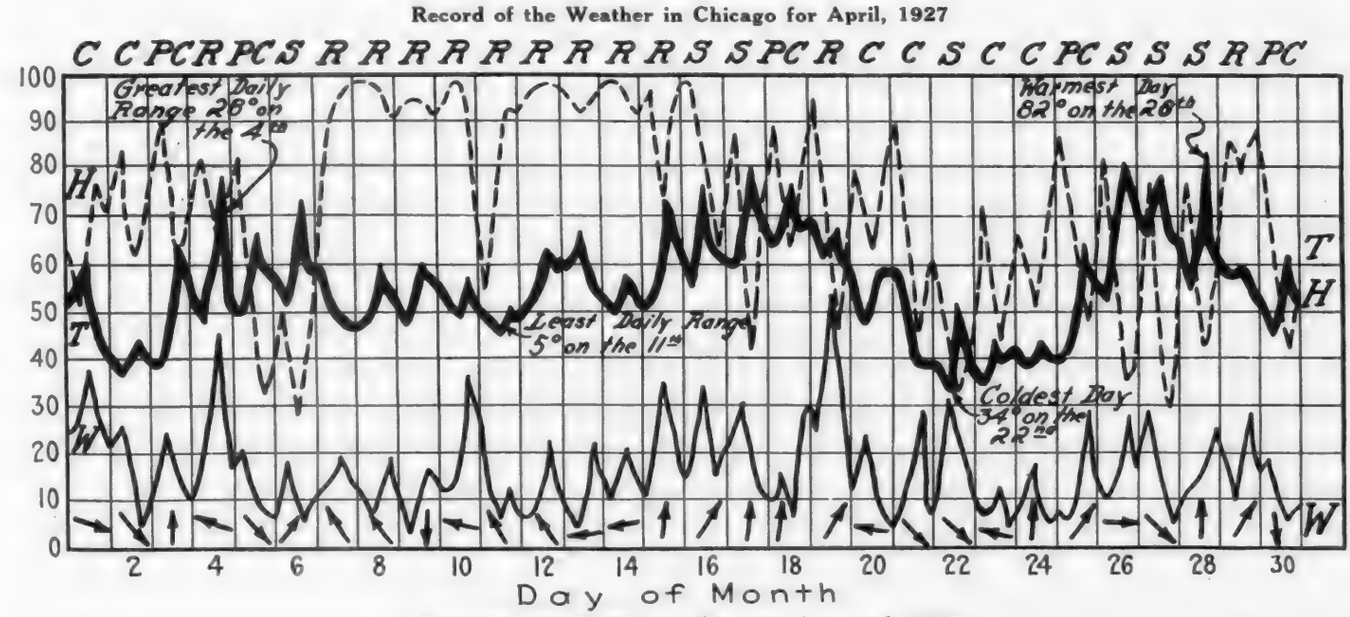
**Record of the Weather in Boston for April, 1927**


R R C PC R R PC PC R S S S R S PC R PC S R S R C C R C R R S R PC
Greatest Daily Range 33° on the 12th
Warmest Day 83° on the 19th
Coldest Day 30° on the 23rd
Least Daily Range 6° on the 3rd
H
T
W
Day of Month

Record of the Weather in Pittsburgh for April, 1927


R PC R R S S C R C PC C R R C R R S R R S R R PC PC R R S R R S
Warmest Day 79° on the 17th
Least Daily Range 5° on the 2nd
Greatest Daily Range 28° on the 15th
Coldest Day 31° on the 22nd
H
T
W
Day of Month

Record of the Weather in Chicago for April, 1927


C C PC R PC S R R R R R R R R R S S PC R C C S C C PC S S S R PC
Greatest Daily Range 28° on the 4th
Warmest Day 82° on the 28th
Least Daily Range 5° on the 11th
Coldest Day 34° on the 22nd
H
T
W
Day of Month

Record of the Weather in St. Louis for April, 1927

Plotted from records especially compiled for THE HEATING AND VENTILATING MAGAZINE by the United States Weather Bureau.
Heavy lines indicate temperatures in degrees F. Light lines indicate wind in miles per hour.
Broken lines indicate humidity in percentage from readings at 8 A.M., 12 M., and 8 P.M. Arrows fly with prevailing directions of wind.
S—Clear, PC—partly cloudy, C—Cloudy, R—rain, Sn—snow.

# Oil Fuel and the Coal Dealer

THE part that fluid fuels are destined to play in the heating of American homes is beyond the vision of the average retail dealer in coal. Too many of these merchants are short-sighted and only see, in the growing use of oil and gas, an enemy to be fought to the death.

In plotting the coal output of the United States from 1899 to 1927, it is found that a straight line can be put through the graph, representing a uniform rate of increase over the greater part of this period. In Fig. 1. this line is shown as A-B. The production rate is not maintained, however, for the last seven or eight years, remaining almost constant for this period. This is represented by the line terminating at C in Fig. 1.

Is it merely a coincidence that this decided break in the production rate of coal (and also in the rate of utilization for domestic heating) almost exactly coincides with the period during which the use of oil in the home has been nationally exploited? Reports from all parts of the country indicate that the retail coal dealer is beginning to find his old customers turning to the fluid fuels—oil and gas.

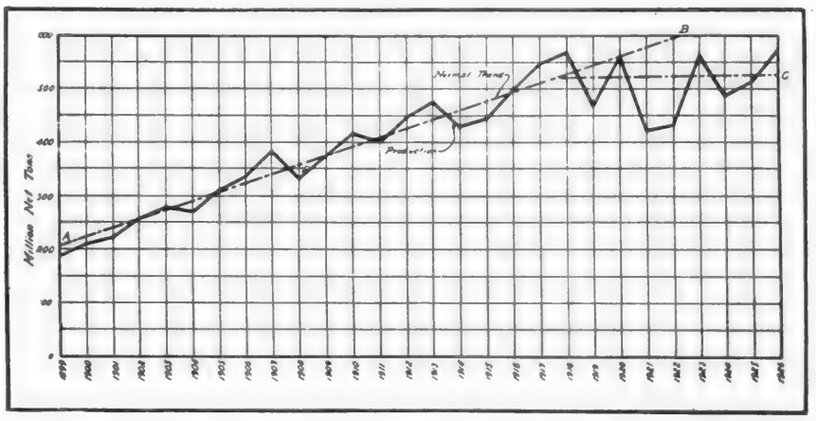



**Fig. 1. Coal Output of the United States from 1899 to 1918**
Since 1918 it has remained constant. The era of national domestic oil-burning began about 1918.

In Fig. 2 is shown the production of petroleum in the United States from 1890 to 1927. Of course only a small part of this production is used for domestic heating, but the tremendous increase since 1920, from 450,000,000 barrels to 770,000,000 barrels, is impressive.

It is evident that oil is going to replace coal in thousands of homes. The question before the retail coal industry is how to meet this competition or—for a better term—loss. Some of the retailers slyly are sending out, with bills, little booklets containing reprinted newspaper stories of oil-burner fires, in the hope, perhaps, of increasing the resistance to oil-burner sales. One such booklet that recently came to light had nothing to identify it, either with the sender or with its printer. It was interesting to see an old standby, the report of the fire in Atlantic City, that was spread from coast to coast, the essentials of which were denied by the chief of the Atlantic City fire department, as told in THE HEATING AND VENTILATING MAGAZINE for December, 1926. There was also a garbled story based on a report of the Underwriters on oil-burner fires, the whole being denied by the underwriters. It goes without saying that no company can build up a lasting business by underhand methods with which it is ashamed to be identified.

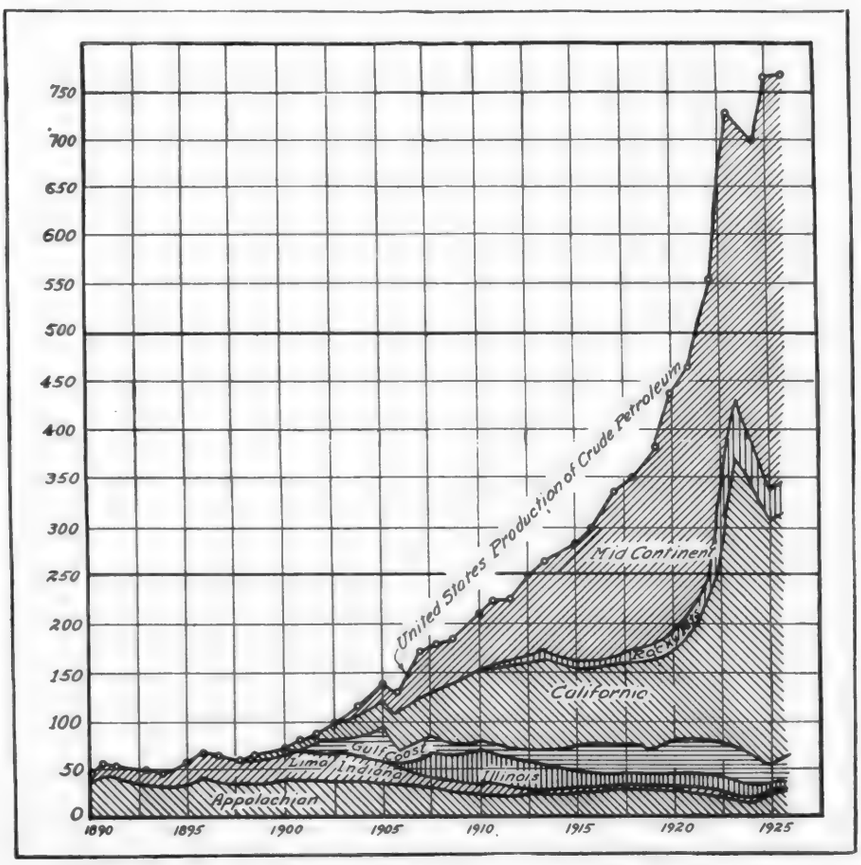


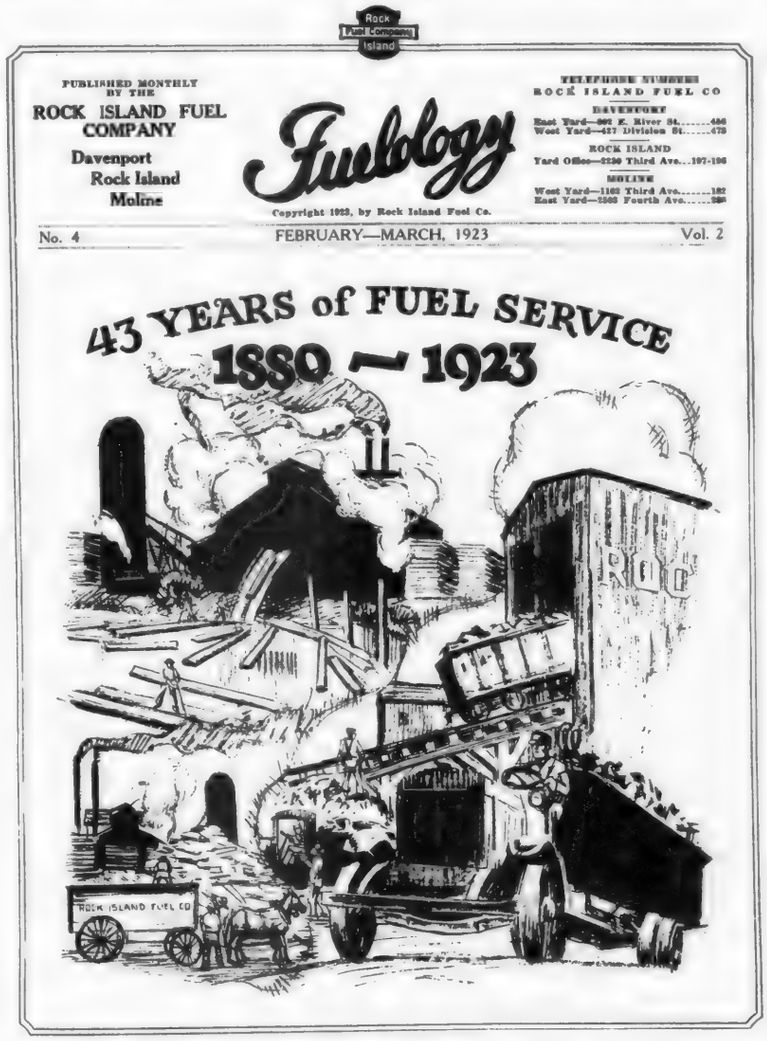

**Fig. 2. Oil Production in the United States from 1890 to 1927**
Note the steady increase during the period of falling off in the use of coal.

An interesting contrast to this attitude is that upon which a leading Middle-West coal dealer has built up in three years, a business in oil fuels that threatens to over-top its coal business of nearly a quarter-century standing. The foundation was laid in 1880, and during the following twenty-one years a big business was built up selling wood, which was put into marketable shape from slab refuse of the many lumber mills in that section. Bobsled and wagon were used for delivery.

Coal was not known as a fuel, although the communities served were located almost on the edge of the Illinois fields. About 1903, the mills began to close for want of timber, and the wood-yard proprietors began to look around for a new fuel. They found it in coal, and, in the intervening time have built up one of the largest establishments in the Middle West.

Three years ago, when the oil-burner commenced to be a factor in house

heating in the three cities served by this organization, the effect on the coal business began to be felt, as coal customers of long standing renounced coal for oil. After carefully studying the possibilities offered by the liquid fuel business, the company entered the field, and today reports that this adjunct is almost as large as the basic business. An official of the company writes:




**Cover of House Organ of Rock Island Fuel Company**

In three years this company has built up an oil sales volume equal to its coal sales resulting from nearly thirty years of business.

"There is no denying the fact that the oil burner has cut deeply into the domestic coal trade and also has made quite an impression in the industrial business. By adding the oil branch to the business, however, we have been able to effect a balance. This end of the business is now developed to the point where it is almost as large as the coal business."

This dealer leaves no stone unturned to give his customers "fuel service." He has a big fleet of trucks and a magnificent fuel-storage and handling plant. The purchaser of an oil burner has only to telephone to this office and a representative will call, ascertain the make and type of burner, estimate the probable rate of consumption for each month of the heating season, all of which is entered on a card. Thereafter oil is delivered to that household with not a thought on the part of the owner. All he has to do is to write checks for the fuel delivered.

The contrast between the two cases cited would lead to the conclusion that much educational work may be done in the retail coal industry. The coal dealers with foresight are going to cash in on this new fuel; those unable to picture the future of oil fuel simply will fight a losing battle, having to drop good customers, one by one, instead of following the lead of the more progressive dealers.

## Bureau Makes Comprehensive Home-Equipment Survey

Practically every State in the Union has been covered by an exhaustive survey of the extent to which heating and plumbing equipment is used in American homes.

The statistical department of the Trade Extension Bureau has compiled data giving the percentage of homes equipped with heating systems, gas water heaters, laundry tubs, stationary bathtubs, wash basins and sinks. The figures show tremendous possibilities for future sales in these products. Copies of data derived from this survey can be secured from the Statistical Department, National Trade Extension Bureau, Evansville, Ind.

## American Radiator Enters Refrigeration Field

The Industrial Division of The American Radiator Company has enlarged its selling organization to meet the requirements of the electric refrigeration industry. The personnel of the division has been augmented by the following representatives:

Walter A. Metcalf, formerly with the York Mfg. Co., York, Pa., and later with the Shipley Construction Co., Brooklyn, will handle business in the New England States, New York and New Jersey. He will make his headquarters at the American Radiator Company's main office in New York.

R. E. Townsend, recently with Pratt-Lambert Co., Buffalo, will cover the trade in western New York, Pennsylvania and Maryland, with headquarters at the American Radiator Company branch, Buffalo, N. Y.

Paul R. Hospe, who was branch manager for the Baker Ice Machine Co., Kansas City, will devote his time to the refrigeration industry in the Central States west of the Mississippi, with headquarters at the American Radiator Co., Kansas City, Mo.

E. J. O'Connell will be stationed at the American Radiator Company office, Los Angeles, and will handle both domestic and commercial refrigeration on the Pacific Coast.

I. J. Knudson, with headquarters at 816 South Michigan Ave., Chicago, will handle domestic refrigerator manufacturers in Illinois, Indiana, Ohio, Michigan and Wisconsin.

A modern and fully-equipped factory has been purchased at Springfield, Ill., to meet the expanding demand for American domestic units and commercial refrigerating sections. The factory has a floor area of 15 acres and is well tooled to manufacture this equipment.

## A. S. Armagnac Recovering from Fall

A. S. Armagnac, editor of THE HEATING AND VENTILATING MAGAZINE, who has been slowly recuperating from the effects of a severe fall down some icy steps early in the year, is now well on the road to recovery and expects to return to his desk by July 1.

# Business of Contracting

## Part II

IN any business it is essential to keep down expenses of an unnecessary character, and it is surprising how various items decrease when employees know that a careful account is being kept of them. This is not petty meanness—it is only business! Some very large firms have carried the practice to the extent even of charging out the pencils they furnish to their clerks and the stationery supplied to their stenographers. The larger the business, the more necessary this becomes, and the greater the savings that will be made. These firms take the attitude that they will furnish everything *necessary* but do not want their supplies deliberately *wasted*.

The average contractor has little need to carry matters to this extreme, but he does need to have an accurate accounting of just what his labor and material are costing him; to do this he must maintain some sort of an accounting system—the simpler, the better. An endeavor should be made to arrive at a system which is simple enough to be easily comprehended and, at the same time, dependable and reasonably accurate. It is the purpose of this article to offer a few suggestions along this line, with the hope that they may prove of service to those struggling with this problem.

In the first place, let us consider the cost of material. The average contractor constantly is purchasing various items, and if these purchases are listed on a card, something like the one illustrated in Fig. 2, reference to this card will give him at a glance the prices paid for such material for a long time back, as well as the more recent purchases. These cards are made out, one for each item, and are posted from the invoices as fast as they come in; it is also a good practice to stamp the invoices as fast as listed and not to pay any invoice until so stamped. This gives an automatic check to insure that *all* invoices are posted and not overlooked.

Such cards should include, as essential information, the date of purchase, from whom purchased, the quantity purchased, the quantity actually received, the net price on the whole order and the net unit price per piece or per pound. Other information may be included, if desired, but the items above listed cannot be dispensed with if results are to be expected. Of course, at the top of the card is a larger space for the heading or description of the material.

The next step is to develop a stock card from which the quantities of material received on the first, or "cost," card are transferred. The purpose of this second card is to determine the quantity of each kind of material on hand, and, if the card is made as shown in Fig. 3, the quantity of material on order also can be determined at a glance. These cards may have the reverse side printed in like form or may have a different arrangement to cover any reservations made out of stock to take care of some future requirement which cannot as yet, be delivered.

Description STOCK CARD Size

| Date | Job or Order No. | Quantity Received | Quantity Delivered | Balance on Hand |
|---|---|---|---|---|
| | | | | |
| | | | | |
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Fig. 3. With This Stock Card, Material on Hand and on Order Is Easily Noted

Description COST CARD Size

| Date Purchased | Supply House | Quantity Ordered | Quantity Received | List Price | Net Cost Lot | Unit Cost |
|---|---|---|---|---|---|---|
| | | | | | | |
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Fig. 2. Convenient Form of Cost Card

Some may question the advisability of employing two separate cards for the above purposes, on the ground that the stock card and the price card can well be combined in one single card of slightly larger size. This is true, but the separate card idea has certain advantages, among which are the keeping of confidential prices so they do not get to be common knowledge in the office, and the lesser liability of their becoming lost, owing to the fact that they are not handled so much and by so many different persons. Besides, on the stock cards it is desired to post up the deliveries, as well as the receipts of material; otherwise the balance on the card will not indicate the quantity on hand.

The delivery of the material in any form and in any quantity should not be made except on a written order signed by someone of responsibility, preferably the foreman or the superintendent; the mechanics should never be allowed to draw out unlimited material, except in cases where they are men of long

Date REQUISITION Job No.

| Quantity | Description | Delivered |
|---|---|---|
| | | |
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| | | |
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Received

**Fig. 4. Typical Requisition Card**

standing and are absolutely trustworthy. A notice posted to the effect that all orders for material must be signed or O K'd by so-and-so and so-and-so is a great help in bringing this state of affairs into existence without undue friction.

Delivery slips, or "requisitions" are made in several forms and styles; some are just single printed slips which the employees fill out in lead pencil and pass in when they receive any material, while more elaborate forms are preferred by some organizations, running up to quadruplicated copies in different colored paper and ink, typed out in style, and copies sent to half a dozen different departments.

Regardless of exactly what finally may be adopted as most suitable for the particular shop, the general information covered by such requisitions should consist of not less than the date, the job, quantity and description of material, by whom received, and by whom delivered. Fig. 4 shows a typical requisition of this character, the use of which should prove satisfactory in the average shop.

Closely related to the matter of requisitions is the one of credit requisitions for material returned. This is necessitated by the fact that surplus material often is left over or material is returned or exchanged. Credit requisitions should be printed in the same form as the regular requisitions, but on different colored paper, to prevent them from being *charged* instead of *credited*. With this system in force there is always a permanent record as to how much material was used on a job and who used it.

*The next section of this article will take up the method of handling contracts and jobs so as to know what is what in regard to the cost of doing work.*

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"Do You Want Your Men Cooler—or More Comfortable? There's a Real Difference," is the title of an article by Director F. C. Houghten, of the A.S.H. & V.E. Research Laboratory, in *Factory*, for May. In this article Mr. Houghten discusses, in popular style, the "effective temperature" charts developed at the society's Research Laboratory. His article is illustrated with a number of these charts, redrawn so as to make them easily understood.

## New Books

PRACTICAL HEATING SYSTEMS, TROUBLE JOBS AND VENTILATION, by E. W. Riesbeck, M.E., is described as a daily guide to all who have to do with heating, ventilating and power plant problems, steam installations, and domestic hot water service. Both the text and illustrations bear the earmarks of having been prepared by a man of practical experience. Special emphasis throughout the work is laid upon trouble jobs—the solution of practical every-day problems that are met with in all kinds of heating plants. For the most part, the book will appeal to the practical steamfitter and heating contractor, although the author's discussion of trouble problems will interest all who have to do with heating and ventilating work. Evidence of the author's familiarity with the latest developments in the heating field, such as the advent of the copper radiator and the electric heating boiler, is given in the chapter titles, although, in the case of copper radiators, no attempt is made to cover the subject in a comprehensive manner. Limp leather, 5 x 7 in. Pp. 277. Price $4. Published by Goodrich J. Drake & Company, Chicago, Ill., or may be had through the book department of THE HEATING AND VENTILATING MAGAZINE.

QUESTIONS AND ANSWERS OF THE PRACTICE AND THEORY OF STEAM AND HOT WATER HEATING, by Robert M. Starbuck, has been published in a new edition. The entire text is written in the popular question and answer form, and covers in a very thorough manner the fundamentals of both steam and water heating. Other chapters are devoted to heat, boilers for heating purposes, the chimney flue, fuels and combustion, and pipe fitting in connection with refrigerating plants. No attempt has been made in this revision to bring the book up-to-date in regard to present practice in oil burning, the use of copper radiators, unit ventilators and unit heaters. On the other hand, vacuum and vapor heating are adequately treated in a chapter devoted to this particular subject. Size 6 x 9 in. Pp. 152, cloth, $2. Published by R. M. Starbuck and Sons, Inc., Hartford, Conn., or may be had through the book department of THE HEATING AND VENTILATING MAGAZINE.

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## Wisconsin Heating Contractors' Annual Meeting

Trade abuses occupied a prominent place in the discussions at the annual convention of the Heating and Piping Contractors Wisconsin Association, held in Milwaukee, April 20. A resolution to the effect that jobbers' salesmen should not figure radiation for incompetent heating contractors was proposed by E. J. Sullivan, of Kenosha, but was tabled. A resolution was passed to call the attention of the national association to a former resolution presented at a previous national convention regarding the spraying of radiators with a non-corrosive substance by manufacturers, and requested the national association to take some action on the matter.

The convention also passed a resolution that steam heating boilers should have a tapped opening immediately over the water-line of the boiler, to be used as a surface blow-off, and tapped openings in the bottom of the boiler, conveniently located, to facilitate thorough cleaning of the boiler. This resolution was to be forwarded to the national association's committee on standardization.

In the matter of "slim type" radiators a resolution was adopted asking the national association to take measures to standardize the different heights, widths and columns, for the convenience of the heating contractors.

New officers are: President, J. Zimmerman, Kenosha; vice-president, A. F. Leitgable, Milwaukee; secretary-treasurer, A. F. Bowers, Milwaukee; sergeant-at-arms, M. Mueller, Milwaukee. Board of directors: Edmund Grassler, Milwaukee; George F. Reeke, Green Bay; Charles A. Honold, Sheboygan; J. B. Sullivan, Stevens Point; J. J. Wiertz, Racine.

At the banquet, held at the conclusion of the convention, President Harry M. Hart, of the National Association, and George M. Gretschow, of Chicago, chairman of the association's boiler output committee, were guests of honor.

# Present Practice in Vapor Heating

Previous articles in this series are:

1. *Webster Type R Modulation System, August*, 1926.
2. *Dunham Home Heating System, August*, 1926.
3. *The Illinois System, September*, 1926.
4. *Hoffman Controlled Heat, September*, 1926.
5. *The Mouat System, October*, 1926.
6. *The Trane System, November*, 1926.
7. *The Sarco System, December*, 1926.
8. *The O-E Perfect 3-in-1 System. January*, 1927.
9. *The Gorton System, February*, 1927.
10. *The Barclay System, May*, 1927.

## 11. The Richardson System

A VAPOR system operating on pressure, vapor and vacuum is embodied in the Richardson system, manufactured by Richardson & Boynton Co., New York. This system is arranged so as to permit operation on mild days at a vapor pressure only a trifle above atmosphere, while in more severe weather this is increased to about 8 oz., and in extreme cold weather to about 1 lb. In design this system is so arranged that after the piping and radiators have become filled with vapor the fire may be allowed to go down and the condensation of the steam or vapor in the radiators will produce a partial vacuum. This vacuum will hold for several hours and vapor will circulate through the system under this negative pressure. Hence the claim of a vapor-vacuum-pressure system.

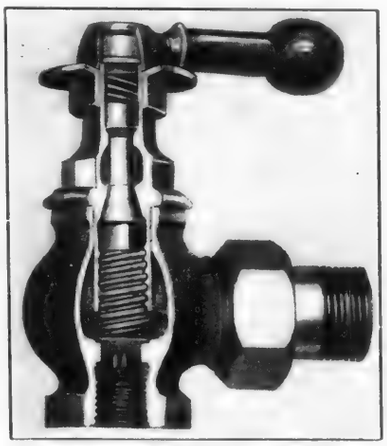


**Fig. 2. Richardson Graduated Supply Valve**

The four most desirable features of this system, as designated by the manufacturer, consist of the ability to be operated so as to meet all climatic conditions, the non-requirement of an experienced operator to manipulate it, the economy in fuel due to its flexibility and its low operating pressure, even in extreme weather conditions.

As shown in Fig. 1, the piping is arranged in the form of a continuous loop header which starts off from the boiler and slopes down continuously as it runs around the building and back to the boiler where it drops below the boiler water-line and is connected to the main return. This drop acts as a drip for the main header. The return main begins at the first radiator fed from the steam main and runs from this point around back to the boiler, paralleling the steam main in such a manner as to balance the circulation by making the first radiator on the steam main the last one from the boiler on the return main, and the radiator closest to the boiler on the return main the farthest radiator from the boiler on the steam main.

The return also slopes down in the direction of flow and drops under the water-line at the boiler where it picks up the steam-main drip and then enters the boiler through the conventional return tapping. Just before dropping under the water-line the return main is equipped with an air expeller and vacuum trap which is designed to take care of the air in the system and to prevent its return when operating under pressures less than the atmosphere. It will also be noted that the return is carried through a check valve before picking up the drip from the steam main.

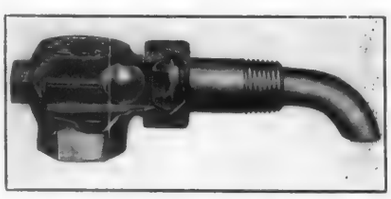


**Fig. 3. Water-Seal Ball Check Union Elbow**

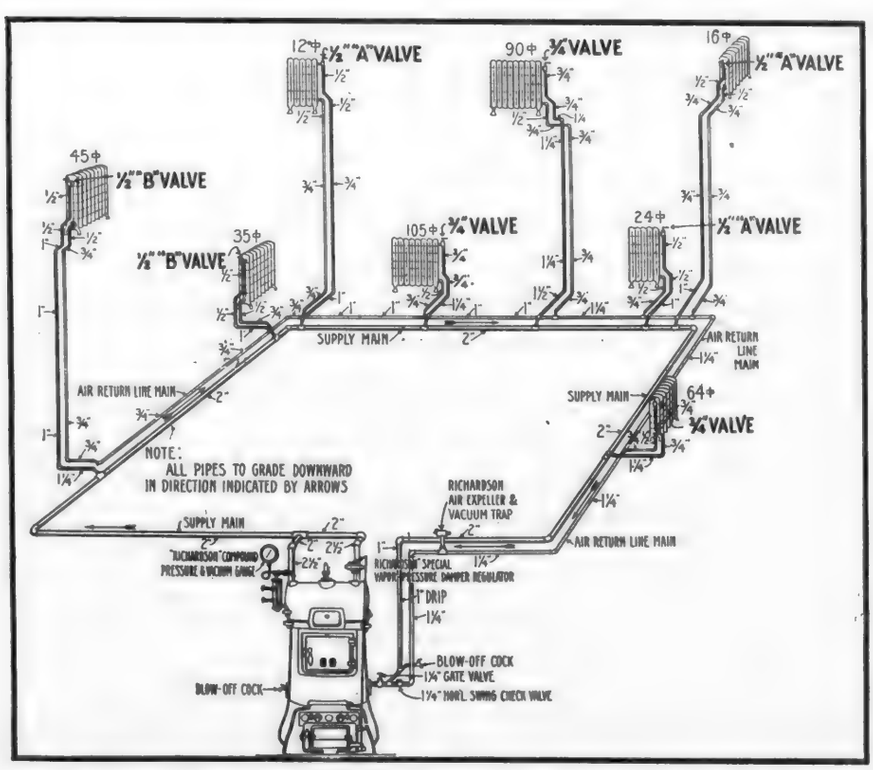



**Fig. 1. Typical Piping Diagram of the Richardson Vapor-Vacuum-Pressure System**

Each radiator is provided with a packless graduated supply valve on the inlet connection; this valve which is illustrated in Fig. 2, has a lever handle and an indicating dial on which four divisions are marked. By moving the pointer over these divisions vapor, supplying approximately one-quarter, one-half, three-quarters or all of the radiator, will be admitted. These valves are all made in only one size—½-in.—but in two styles; the first style known as the "A" valve is suitable for radiators up to 30 sq. ft. in size, and the other style, known as the "B" type valve, is designed to handle radiators from 30 sq. ft. to 50 sq. ft. in size.

On the return end of each radiator is attached a special water-seal, ball check, union radiator elbow, shown in Fig. 3. It will be noted that this elbow has an interior bend turning down into the water pocket in the return-leg section of the radiator so as to water-seal the outlet. To permit the escape of air from the radiators a small hole or air-

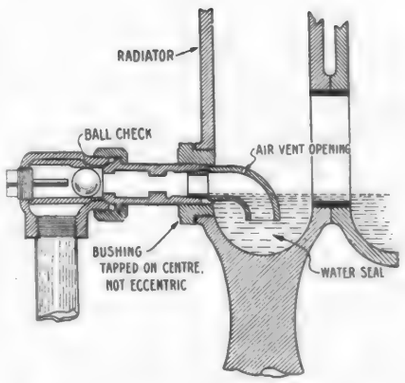



**Fig. 4. Section of Ball Check and Water Seal**

vent opening is provided in the top of this bend, the whole being connected up to the radiator in the manner shown in Fig. 4.

The air expeller and vacuum valve is illustrated in Fig. 5; one of these devices is placed on the end of each line carrying air before the pipe drops under the water-line. This air expeller is for the purpose of relieving air automatically from the system but closes by expansion as soon as steam or vapor strikes it. On the outlet of the air expeller is located a vacuum device to prevent the return of air after it is once expelled and in this way to produce a vacuum as the system cools down.

The check valve previously mentioned as being used on the return is also of special design, with the flapper hung vertically and is shown in Fig. 6. This check has been specially developed for use with the Richardson system.

Other appliances which are required to make up the completed system consist of a compound pressure-and-vacuum gauge for the boiler and a special vapor damper-regulator which is connected to the draft and check damper on the boiler.

It is advisable to use water-type radiators with this system, the same as with any vapor installation, and the tappings on the radiators are preferably made top-inlet and bottom-outlet, opposite ends. The radiator sizes are the same as ordinarily would be used with common gravity steam heating.

For sizing pipes the following tables are presented, these tables being based on the assumption that there is sufficient radiation to maintain 70° F., and that no unusual conditions prevail:

Supply mains not exceeding 100 lin. ft. in length:

| Sq. Ft. Radiation | Pipe Size, In. Diam. |
|---|---|
| 150 | 1½ |
| 400 | 2 |
| 600 | 2½ |
| 1000 | 3 |
| 1400 | 3½ |
| 2000 | 4 |

**Fig. 5. Air Expeller and Vacuum Valve**

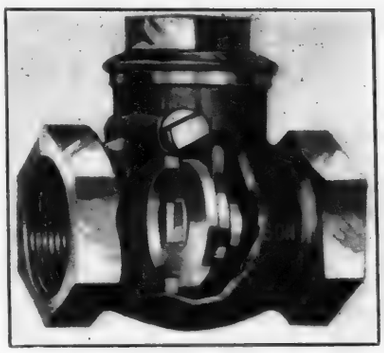


**Fig. 6. Horizontal Swinging Check Valve Designed Especially for Use with the Richardson System**

Air Return Line Mains:

| Sq. Ft. Radiation | Pipe Size, In. Diam. |
|---|---|
| 80 | ¾ |
| 200 | 1 |
| 800 | 1¼ |
| 1500 | 1½ |
| 4000 | 2 |

Risers up to 30 lin. ft. high:

| Sq. Ft. Radiation | Supply Riser In. Diam. | Return Riser In. Diam. |
|---|---|---|
| 20 | ¾ | ¾ |
| 60 | 1 | ¾ |
| 100 | 1¼ | ¾ |
| 180 | 1½ | ¾ |

Wet Return Mains:

| Sq. Ft. Radiation | Pipe Size, In. Diam. |
|---|---|
| 400 | 1 |
| 1000 | 1¼ |
| 1800 | 1½ |
| 5000 | 2 |

# Cleveland Uses Billboards to Advertise Certified Heating

It is difficult for residents of Cleveland, or for visitors to the city, to move about their business without coming face-to-face with the many billboards that are being used by The Heating and Piping Contractors Cleveland Association to sell Certified Heating. Several appeals have been worked out around a standardized presentation, and it is reported that the signboards are "pulling."

SATISFACTORY HEATING
is Guaranteed Without Extra Cost if you install
"Certified Heating" SYSTEMS
Installed only by Members of
The HEATING & PIPING CONTRACTORS ASS'N.
406-8 CHESTER-TWELFTH BLDG.
MAIN 1444
ART HERSHE MANAGER

**Two of the Billboards Used in Cleveland to Spread the Gospel of Certified Heating**

# Metal Hose in the Oil-Burner Field

ONLY a few months ago flexible tubing was frowned upon by the Underwriters, but the demand for such a commodity, and the intensive research work that has been done in the last year, have resulted in the approval of certain kinds of flexible tubing by the Underwriters.

Because of the wide interest in the subject in this field of application, and of the possibilities that tubing of this kind may find uses in other branches of the heating industry, the following comments by C. W. Fletcher, president, Tite-Flex Metal Hose Company, are of value:

"There are now three distinct types of flexible tubing on the market, the first, which is the oldest and most widely known, dating from about 1885, being the full interlocked, in which a metal ribbon strip is helically wound and interfolded on the edges in such a way as to form ridges that limit the travel of adjacent convolutions when the tubing is bent. In the process of fabrication a cord is laid in a retaining groove for the purpose of confining the fluids under pressure and preventing their escape.

"The second type is the development of a patent issued in 1888 for a corrugated tube as an expansion joint. A solid seamless tube is passed through a die, having a helical thread gradually working corrugations of a spiral form along its length. This tubing, when finished, depends upon a slight bend in the side walls of each corrugation to give it flexibility; the sum total of the movement in all corrugations defining the degree of flexibility.

"The third type, patented in 1912, is made from a very thin flexible metal strip, wound in such manner that it has helical corrugations with the edges interfolded and locked into position, forming a fixed seam. Flexibility is obtained through the diaphragm action of the adjacent corrugations and is limited by a restricting latticed armor braiding.

### DEMANDS OF OIL BURNER INDUSTRY HASTEN DEVELOPMENT

"In the early stages of the oil-burner industry installations were made with the best known means at hand, usually solid pipe connections. In many instances objectionable noises were transmitted by the pipe lines, which, it was found, could largely be eliminated by the use of flexible connections. Then, too, it was found that installations could be simplified and that measurements need not be so exact when flexible connections were used.

"But the art had outgrown the laws which controlled it. Local ordinances in force, in many instances enacted years ago, prohibited the use of flexible connections. The regulations in force in different parts of the country varied so greatly that manufacturers of oil-burning equipment hesitated to incorporate tubing as part of the equipment and left the means of connecting to the installation crew of the local dealer or distributor. This practice resulted in a vast assortment of different kinds of assemblies, some good, but many totally inadequate to solve the particular problem.

### THREE PRINCIPAL FUNCTIONS OF FLEXIBLE HOSE

"A study of the situation reveals that there are some well defined reasons for the use of flexible connections:

1. To absorb vibration.
2. To accommodate some required movement.
3. To facilitate and simplify the installation.

"1. When flexible metal hose is used to take up vibration it preferably should be installed in a straight line position, as tests show that in this position vibration is distributed evenly throughout the length. In a bent or off-set position, the greater part of the vibration is taken up on the moving end below the point of maximum bend and tends to concentrate or localize on a short length, inviting a rupture; whereas the length would have given perfect service if properly installed. The length suitable for a vibration joint can be determined for each type manufactured, with the hope that a standard length can be adopted. This should be a length between 12 in. and 15 in.

"2. Obviously, in view of the fact that metallic hose cannot be considered the equivalent of standard iron pipe, longer lengths of hose should not be installed than are absolutely necessary to accomplish the purpose for which they are intended. Unnecessarily long lengths of hose will result in installations being made in such a manner that the hose will be exposed to mechanical injury. Of course, hose should be installed at all times in such a manner that it will be protected to the greatest possible degree from mechanical injury. Whether the length recommended by any one tubing manufacturer to accomplish a given bend will agree with that advised by any other manufacturer can be determined only by some supervising institution, but it would seem that a standard length could be determined and decided on for installations requiring movement of one part relative to another. Flexible tubing should not be bent to a radius less than 5 in.

"3. When tubing is used for convenience in coupling up, the problem becomes simple, but a longer length than necessary to accomplish the connection should not be used. An off-set, if required, should not be greater than 2 in. per ft. of tubing, if subject to movement. If movement is not present the tubing can take any bend that has a radius above 10 in.

"As all tubing is spirally wound or corrugated, a torsional movement is detrimental to its life, as it tends to change the relative position of adjacent convolutions and in time lessens its ability to withstand pressure.

### BRAIDING PROTECTS TUBING

"A safeguard against torsion can be provided in the form of a lattice braiding and no tubing should be installed without this armor. Some tubing has two braidings and this feature should be incorporated as standard practise when installed in connection with oil-burner equipment.

"As braiding only tends to resist torsional stresses in some measure, a further safeguard against twisting can be provided by assembling on each end of each piece of tubing a union coupling, endeavoring to eliminate, as far as possible, the possibility of twisting the hose, either intentionally or unintentionally, during installation.

"It is easy to recognize the fact that no one outside of the manufacturer knows as much about his particular apparatus as he himself does. It is likewise axiomatic that the tubing manufacturer is the one best qualified to make recommendations for his product and should be freely consulted in adopting a design in which tubing is to be used. If the selection of all the metal tubing was made by the burner manufacturer for his particular apparatus with definite printed instructions for installation following the recommended practise, much better results would follow and a higher standard could be maintained. The manufacturer who is keen to give the best service would not jeopardize his best interests by letting inferior tubing or poor installations reflect on his equipment.

"He would select the best, and follow the recommendations given by the tubing manufacturer who has had experience in this as well as other fields.

"Flexible metallic tubing by the very nature of its consideration can be easily injured if improperly installed or handled. Care should be taken by manufacturers of oil-burning equipment to see that installation instructions are followed and care used in the handling of the tubing equal to that given other parts of his apparatus.

### A SUGGESTED SPECIFICATION OUTLINE

"In the absence of a code of specifications under which flexible metallic tubing can be selected, the following are suggested as desirable features in the hope that they may lead to a code of standards:

"When flexible metallic tubing is to be included as a part of a system, it is considered essential that it be assembled and tested at the factory as an inclusive part of the equipment.

"No tubing having leaded on or soldered connections should be installed in a zone, the temperature of which rises above 150° F. When the temperature is uncertain or is known to go above 150° F. solderless or pressure fittings only should be used.

"Flexible metallic tubing should be installed in such a way that movement will take place in one plane only, so as to eliminate torsion.

"When movement is required in more than one plane, a special connection suitable for the service should be used.

"The minimum length of vibration joints should not be less than 12 in. of tube—or greater than 15 in. (excluding couplings).

"The maximum unsupported length of tubing should not exceed 18 in.

"For the oil-burner industry the minimum inside diameter of tubing should not be less than ¼ in. or greater than ½ in.

"The minimum inside radius of bends should not be less than 5 in.

"Unions should be used on each end of the tubing.

"Straight connections are suggested as preferable to off-sets or bonds.

"Installations should be made in such lengths that there will be no tension on the hose after connections are screwed up.

"No soldered joints should be used.

"When movement is present, maximum off-set permissible should be 2 in. per ft. of tubing.

"Tubing with connections should be capable of withstanding twice the working pressure."

# Nokol Convention Draws Delegates from Many States

NEARLY 300 delegates and guests of the American Nokol Company gathered at the Edgewater Beach Hotel, Chicago, for Nokol's third national convention, May 3-5, 1927. These three days of the convention were crammed full with a program carried out almost entirely by members of the Nokol organization, under the chairmanship of C. L. Bode, director of sales of the American Nokol Company.

Tuesday forenoon was spent at the factory where the delegates were welcomed by Albert J. Frenier, vice-president and chief engineer, and C. E. Shields, factory manager. Three months ago when this factory was taken over, there was nothing but the shell of a building and some machinery, but the delegates found it a busy place indeed with the new production program in full sway. Following the welcome of Mr. Frenier, the delegates were divided into groups and distributed through the factory. In the assembly department, they watched the assembly of burners on three-wheel carriages, on which they are moved after final inspection to the test department, where each burner is given a test, varying from three to eight hours, during which records are made for future reference. The research laboratory probably was the focal point of interest on account of its unusually complete equipment and the interesting work that is being carried on.

The annual banquet, Tuesday evening, was featured by the presentation of dealers' and national sales contest prizes and addresses by Morgan J. Hammers, president, and Albert J. Frenier. At the speakers' table also were C. L. Bode, W. A. Kemp and C. E. Shields. Mr. Hammers spoke very feelingly of the skill with which Mr. Frenier had carried out the necessary engineering work during the past ten years and concluded by dedicating the new Nokol plant to him. In discussing the merchandising plans for the coming season, Mr. Hammers pointed out the good results that undoubtedly would come from the advertising campaign of the American Oil Burner Association and said that the Nokol advertising and sales work would be carried on as intensively, with full regard for the highest code of ethics in selling.

Mr. Frenier spoke briefly, in his entertaining way, of the trials and troubles of the last ten years, during which the present Nokol has been evolved.

The banquet was enlivened by impromptu songs and cheers from different sales organizations and at its conclusion a collection of $250 was taken up for the relief of flood sufferers in the South.

On Wednesday morning three simultaneous meetings were held in different rooms, a dealers' division under the chairmanship of C. L. Bode, a sales division meeting with H. J. McDargh in the chair, and a service division, under the leadership of W. A. Kemp. In each of these sessions details connected with the various phases of merchandising and servicing Nokol burners were discussed. On Wednesday afternoon the delegates met as a whole with the following program: "The Oil Industry Awake," by H. J. McDargh; "Nokol Club of Boston," by George Cormack, Milwaukee, Wis.; "Our Need of Standard Accounting," by A. Jack Becker, St. Louis, Mo.; "Finding Your Costs," by Carl M. Noetzel, Washington, D. C.

**Third Annual Dinner of Delegates to American Nokol Company's Convention**

**Delegates in the Test Room of Nokol's New Factory**

On Thursday morning again there were three division meetings under the same chairmen who conducted the previous day's discussion. In the afternoon another joint meeting was held, the guest speaker being Homer R. Linn, of the American Radiator Company, on "Relation of Boilers to Burners." The program concluding with the following: "Advertising in 1926 and Plans for 1927," U. B. Groves; "The Part That Advertising Has Played in the 'Survival of the Fittest'," Heber H. Smith, vice-president, Green, Fulton, Cunningham Co., Chicago; "A Job Versus an Opportunity," A. Douglas Irvine, Philadelphia, Pa.; "Selling Nokol," Frederick K. Daggett, Hartford, Conn.

# Atmospheric Problems in Cigarette Manufacturing

HOW important atmospheric conditions are in the manufacture of cigarettes, is told by B. H. Vance, superintendent of the New York City plant of the P. Lorillard Company, writing in *Factory*, for April. He refers particularly to the processes involved in the making of Murad cigarettes.

"All of our tobacco," he states, "comes from Turkey in rather tightly pressed bales. Most of it has been in this condition something like four years, and it is far too dry and brittle to stand any handling of individual leaves.

"So first the bales are opened in a conditioning room, where the temperature is kept practically unvarying, at 75° F., and the relative humidity is kept at 85%. These conditions are made possible by the circulation of automatically conditioned air. Exposed to them, the tobacco in the bales absorbs moisture, becomes soft and pliable, and is fit for separation.

"After the bales are properly conditioned, the leaves are separated and are exposed to a finely atomized water spray. Then the leaves are allowed to stand in tubs for 24 hours, which gives them still more pliability. Then they are sorted and mixed, one grade with another, to form the proper blend. In the rotary mixer and tempering machine there is a somewhat further softening, made by a small spray of steam.

"To allow the moisture to diffuse itself evenly and completely throughout the mass, the mixed leaves are left for 72 hours in covered trucks in a room in which the humidity is automatically held constant.

### HUMIDITY IS CONSTANT IN STORAGE ROOM

"Next the leaves are cut into shreds and again are thoroughly mixed to assure a uniform blending. Then again the tobacco stands for 72 hours in a storage room where humidity is maintained.

"In the room which houses the cigarette-making machines, air of fixed humidity and temperature, summer and winter, is circulated. Such a uniformity of air, together with the fact that the tobacco is prepared in a uniform atmosphere, results in a tightly-wrapped, even product, rather than in an uneven, lumpy cigarette—a frequent former result. Tobacco will not feed satisfactorily unless its moisture content is just exactly right.

"In the packing-room, 300 girls are occupied in the hand-packing of cigarettes, sorting and laying the cigarettes, with the monogram "just so," in foil-lined boxes. The revenue stamping and glazed-paper wrapping are done by machines, also in this room. In this room cooling and dehumidifying the air during the summer months is of particular importance. Perspiration from fingers is ruinous to choice hand-packed cigarettes. A temperature of about 70° and a relative humidity of 55% are maintained in this room throughout the year. Under these conditions the employees are enabled to work with equal efficiency each day. This is in contrast to the frequent lay-offs enforced by extremely humid weather, when plant conditions are uncontrolled.

"Perhaps we could get along without a humidifier, but not without a dehumidifier.

"We can wet the tobacco to get moisture into it; but we cannot heat Turkish tobacco to dry it, since this removes the oils which it contains and hence destroys the flavor.

### THE BENEFITS FROM IMPROVED AIR CONDITIONING

"It may be interesting to note that we used to humidify by blowing steam through the room, but this was not at all satisfactory, for the room was too wet near the nozzles and too dry farther away."

## Domestic Oil Burners Are Manufactured in England

The black clouds of dense smoke for which England is noted may give way to clear skies in the future with the adoption of oil as a domestic fuel throughout the Kingdom. English manufacturers of domestic oil-burning equipment are anouncing their products in the technical press and it remains to be seen how rapidly the idea can be spread. One of the first oil burners to be developed in England is the Filma, which has been worked out to a high degree of refinement. In view of the comparatively small number of what the Englishman is pleased to call "central heating boilers" in British homes, the ultimate market for such a burner, of course, is far below what it is in the United States.

## Nokol Sales Contest Awards

The sales contest which was inaugurated by American Nokol Company, in November, has just been brought to a close and the prize winners have been announced.

H. W. Barrows, of the Cornell Utilities Co., New York, was the first-prize winner. Fred Houshalter, of the Automatic Heat Corp., Detroit, won the second prize, and L. S. Andrews, of the Connecticut Oil Heating Co., Hartford, finishing in third place. Mr. Barrows sold 43 burners, Mr. Houshalter, 31, and Mr. Andrews, 31. The dealers cup went to the Automatic Heat Corp., Detroit, with a total score of 100 points; Buckley & Scott, Inc., Philadelphia, finished second, and the Connecticut Oil Heating Co., Hartford, third.

This contest has proved to be a great sales stimulant and materially boosted Nokol sales throughout the country.

# New Apparatus and Appliances

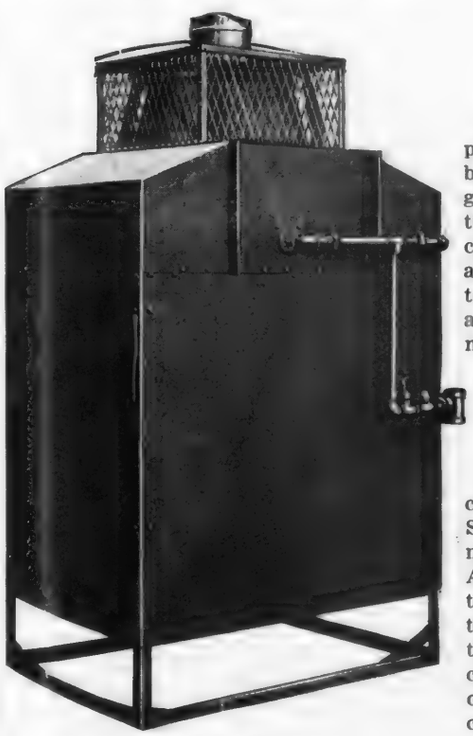
## Oil-or-Kol Steel Boilers

An electrically-welded steel boiler for residences and small buildings, incorporating interesting features of design, is announced by Lebanon Boiler Works, Lebanon, Pa. The boiler is a vertical double shell with horizontal fire-tubes providing for secondary heating surface, with clean-out doors so arranged that the tubes easily can be reached. It is built to the A. S. M. E. code and is rated on the basis of net radiation required for radiators and mains.

There are nine sizes, rated from 300 sq. ft. of steam to 2500 sq. ft., based on anthracite fuel, with corresponding ratings from 375 sq. ft. to 3125 sq. ft. where oil fuel is used. The five smallest sizes will pass through standard doorways.

## Clarage Unit Heater

A unit heater, described as radically different from any unit heating equipment at present on the market, has been developed by the Clarage Fan Co., Kalamazoo, Mich. The unique feature



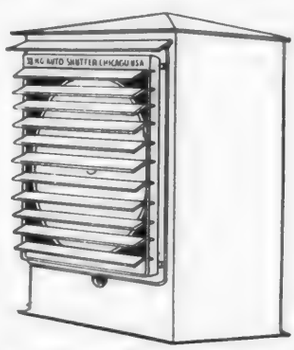
Clarage Unit Heater

of the design is the use of a positive centrifugal fan of the backward curve blade type, which makes it possible for the unit to deliver warm air radially in all directions.

The Clarage unit heaters are built in both floor and ceiling types to meet all industrial heating requirements. They are shipped completely assembled in order to be quickly installed.

## Ilg Power Roof Ventilator

An interesting type of power roof ventilator, designed particularly for one-story stores, factories, theatres, and for lodge rooms and dance halls located on the top floor, has been brought out by the Ilg Electric Ventilating Co., Chicago, Ill., under the name of the Ilg power roof ventilator. Incorporated in the unit is an Ilg self-cooled motor propeller fan, installed in a heavy-duty pent house, equipped with an Ilg aluminum automatic shutter.

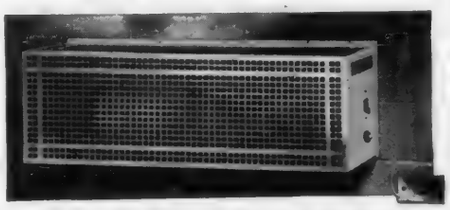


Ilg Power Roof Ventilator

According to tests made by the company, one Ilg power roof ventilator has been found equal to three ordinary gravity or natural ventilators. In addition to its use in buildings with hung coilings, it is also described as especially adaptable for ventilating certain types of two and three story structures, where a straight air-shaft can be used. It is made in sizes ranging from 12 to 72 in.

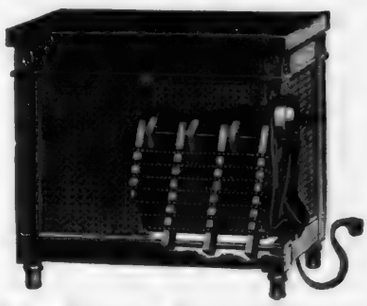
## Slyker Electric Air Heater

An electric air heater of the radiator cabinet type has been brought out by Schleicher, Inc., Gary, Ind., under the name of the Slyker electric air heater. Air is heated by passing over a new type of element which gives a surface temperature, it is stated, no higher than that of a steam radiator. The element consists of stainless metal ribbon curls on porcelain racks, which deliver a constant flow of heated air into the room.



Slyker Wall-Type Electric Radiator

The Slyker electric air heaters are built entirely of steel and are furnished in period effects to harmonize with the furniture. They are designed to operate on any current, the only change neces-



Slyker Radiator, Showing Metal Ribbon Electric Heating Element

sary being a minor alteration in the electric outlets for the installation of heavy-duty connections, consisting of a molded rubber-covered type S three-conductor cord, with standard three-conductor cap. The third conductor is used to connect the steel body to the conduit system so as to eliminate any possibility of a shock. A heavy-duty three-heat switch is mounted on the inside of the body, with an operating knob on the outside which indicates the switch position without stooping. The heater is furnished in a number of lengths and widths, ranging from 22-in. long and 20-in. high to 40-in. long and 30-in. high, and is made in both floor and wall types. The width is uniform at 12-in. and equivalent of steam radiation ranges from 17 to 68 sq. ft. The heater also contains a humidifying pan.

## Richardson & Boynton Company Enters Steel-Furnace Field

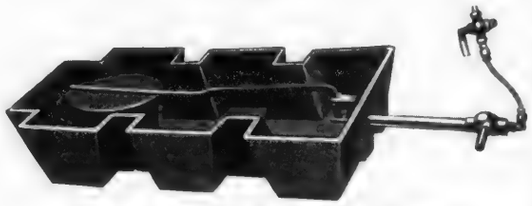
Announcing a new all-steel furnace under the trade name of Perfect, Richardson & Boynton Co., New York, presents a unit designed for both liquid and solid fuels, with particular attention paid to the requirements of the former. While conventional in design, the new furnace shows that much thought has been given to the ease with which present-day oil burners can be installed and to the efficiencies that can be obtained with this fuel. The combustion-chamber shell is of copper-bearing steel plate, cold riveted and welded, lined with fire brick. The grates are set unusually high, making the ash-pit door almost square, and permitting ready installation of such burners as are fired into the ash-pit.

A large supplementary surface, or radiator, is an integral part of the furnace, reducing stack temperatures. This, too, is riveted and welded, making it gas tight. A large water pan is provided for humidification. Six sizes are listed, with grates from 18 in. to 30 in. diameter, and rated from 450 sq. in. to 1350 sq. in. of warm-air pipe area.

## Automatic Warm-Air Furnace Humidifier

A warm-air furnace humidifier, automatically operated and consisting of a cast-iron receptacle or trough, placed on top of the radiator, has been brought out by Emil Buehrer, Green Bay, Wis., under the name of the Efficient Humidifier. The receptacle contains a float which is designed automatically to maintain constant water level in the trough. The float valve is connected to the water line, so that this supply of water may be constantly renewed whenever the float drops, due to evaporation. Mr. Buehrer, the designer of the humidifier, has made a study of humidification in connection with warm-air furnaces and finds that apparently it is necessary to evaporate from 10 to 20 gal. a day in an ordinary 8-room house, or 70 to 140 gal. a week, in order satisfactorily to humidify the air.

Installation of Efficient Humidifier in Warm-Air Furnace



Construction of Efficient Humidifier

In reviewing the many suggestions that have been made to maintain a proper humidity with warm-air furnaces, Mr. Buehrer refers to the use of wet muslin strips placed below the floor register. Another scheme he mentions is the use of water receptacles, including those containing growing plants. If such receptacles are set near electric fans, evaporation is increased. In his design, Mr. Buehrer has sought to provide a device which is automatic, does not require attention, except twice a year, and which will maintain a sufficient amount of humidity. The regulation of the amount of evaporation was a matter which at first seemed to Mr. Buehrer to be of considerable importance.

He found by experiment, however, that where 20 gal. perhaps might be needed for evaporation on extremely cold days, only 5 gal. would be required when the weather was very mild. Experiments showed that when the temperature was higher, less fuel was consumed and consequently, less water was evaporated. There seems to be a corresponding harmony between the two, so that the average in winter and in spring varies only a few percent, if any. The humidifier is listed at $14.00.

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## The Johnson Cub Oil Burner

Designed for the heating plant of the small home, for service-water heating, or similar loads, a burner known as the Cub is announced by S. T. Johnson Co., Oakland, Cal.

The burner follows, as to type, the well-developed line of rotary-cup atomizing burners and is designed for fuels of 32° A.P.I. and lighter. The entire burner unit is so light that it can be held at arm's length, the housing for the motor and fan being of polished cast aluminum. This unit swings on hinges through one of which the oil is fed to the burner. The rotating-cup atomizer is similar to that used for the last twelve years in Johnson burners. Primary air is supplied both to the inside of and around the atomizing cup, while secondary air enters the combustion chamber through a larger annular opening, this design resulting in a thorough mixing of oil-gas and air.

The Johnson Cub Burner Is Simple and Light

The Westinghouse motor used is rated at 1/12 H.P. at 3450 r.p.m. A Minneapolis heat regulator is standard equipment, and is the only portion of the burner that is not manufactured by the Johnson Company.

Ignition is by an expanding gas-valve, normally using a negligible quantity of gas.

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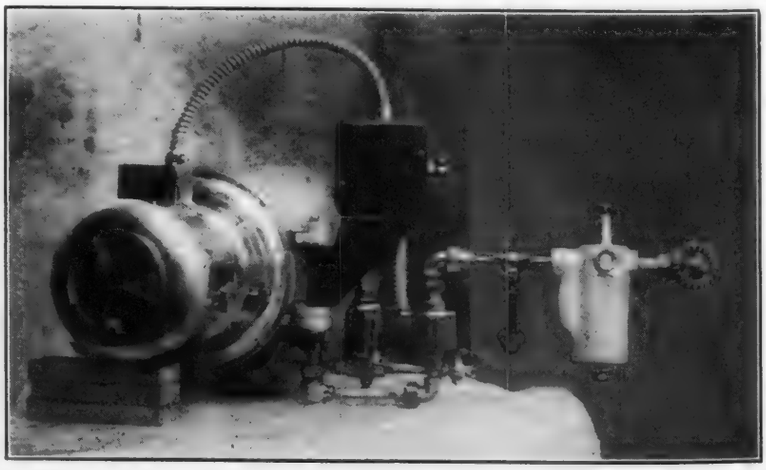
**Evins F. Glore & Son, Inc.,** Grand Central Terminal Bldg., New York, has been appointed exclusive representative in the New York district for the Republic Radiator Co., of Baltimore. A warehouse stock is being maintained at Verona and Imlay Sts., Brooklyn, N. Y.

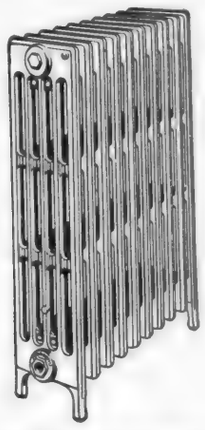


The New Johnson Cub Burner

## New Richmond Radiator

After much designing and redesigning, casting and again casting from what was each time thought to be the final pattern, the Richmond Radiator Co., New York, recently finished the design and has just started production on this latest addition to the Richmond line. The new radiator is tall and graceful in appearance, with each part in harmony. Even the legs on the leg section conform in style with the main section of the radiator. There are no beads or other obstructions to the free flow of air in and about the vertical tubes.

The air space between adjacent sections is 1 13/16 in. permitting increased heating efficiency. The value of this increased space will be appreciated when it is stated that in old-style radiators the heating effect of the outer surface of the end sections was about 80% greater than that of the heating effect between sections.



**Richmond Stream-Line Radiator**

Exceptionally large waterways are provided in the vertical tubes, a feature of particular advantage in water heating in permitting more rapid water circulation. Because of greater space between adjacent sections cleaning and painting operations are simplified, the space between sections being greater than such space on the old-style special hospital radiators.

The company has prepared an attractive folder fully illustrating the radiator and giving complete specifications as to mechanical details.

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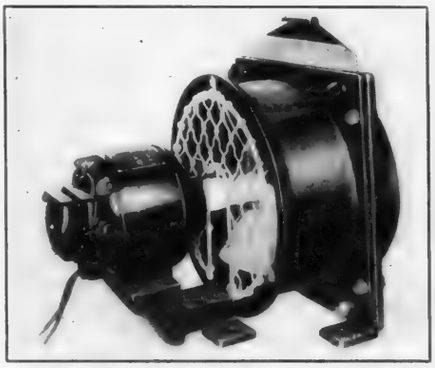
## Forced-Draft Unit for Domestic Heater

A forced-draft blower designed for use with domestic heating-boilers and furnaces has been placed on the market by L. J. Wing Mfg. Co., New York. This unit consists of a motor-driven fan which can be arranged to operate under thermostatic control. The unit is designed for boilers, having 5 sq. ft. of grate area or less. The blower unit



**Wing Forced-Draft Blower for Domestic Heater**

is bolted directly to the heating equipment without ducts and occupies approximately 1 cu. ft. of space. The motor is fully enclosed and dust-proof and requires only 1/20 H.P. for its operation. Under thermostatic control the blower is turned off and on to maintain a constant steam pressure or temperature. The intensity of the draft also can be varied by means of a sliding damper. By using such a unit, the home-owner can burn buckwheat and similar small-sized coal selling at about half the cost per ton of conventional furnace sizes.

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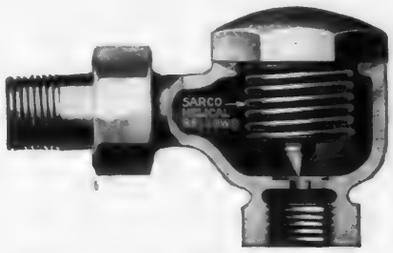
## New Federal Gauges

A combined altitude gauge and thermometer, and a retard gauge are announced by the Federal Gauge Co., Chicago. The former is a duplex instrument with bi-metallic element, thus eliminating the thermometer glass stem. The latter is a gauge reading up to 30 lbs. in which the range from zero to 10 lbs. is graduated in ounces, with 5 lb. marks between 10 and 30 lbs. This gauge also may be obtained graduated to 5 lbs. in ounces and retarded from 5 lbs. to 30 lbs.

**Federal Combined Altitude Gauge and Thermometer**

## Sarco Trap for Small Radiators

To meet a demand for a trap designed especially for small installations, Sarco Co., 183 Madison Ave., New York, has developed a ½-in. size, which has been designated Type H. Aside from its small size, the trap is described as having all the outstanding features of the regular Sarco trap. It is intended for




**Sarco Trap for Use with Small Radiators**

radiators from 125 sq. ft. down. The new trap is described as having an unusually large discharge and high lift to enable it to pass all water and air as soon as it accumulates. Being standard in dimensions, it can be installed where any ½-in. trap will fit. The casing is made of cast brass, nickeled.

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## 'Vitolyzed-Air' Corporation Introduces New Air-Conditioning Equipment

Announcing equipment for air conditioning in theatres, factories, and places of similar requirements, due to human congestion or industrial processes, 'Vitolyzed-Air' Corp., 1926 Broadway, New York, brings to this branch of the industry some novel developments.

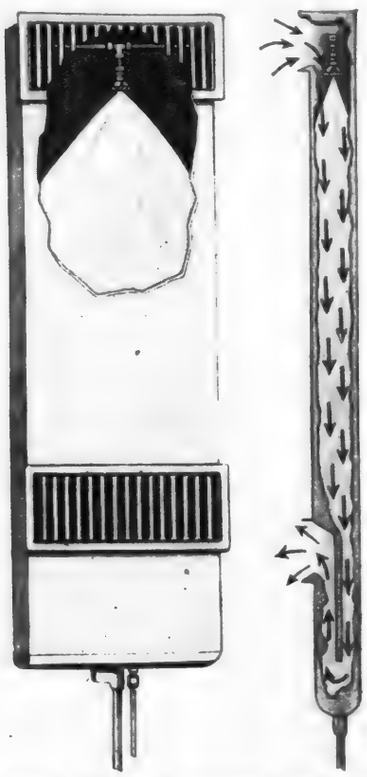
The element of greatest interest is the dirt eliminator or cleaning compartment, consisting of a number of tiers of horizontal V-shaped plates supporting the cleansing material which is a special grade of felt. The sides of these channels are set at 30° angles and the felt is kept moistened by a set of sprays. The surplus water from the eliminator falls to a pan extending under the entire unit; the dirt is precipitated to the bottom and the water is recirculated by a motor-driven pump.

Prior to entering the eliminator the air passes through a washing section where it is drawn through the mist produced by a bank of nozzles. This chamber is 4 ft. long, insuring thorough moisture-charging of the air. The eliminator section is nearly as deep, and the shape of the plates and arrangement of air passages is such that a minimum resistance is offered. Inspection and cleaning doors are provided and a waterproof electric lighting system permits the observation of the unit when it is in operation.

A blower is used, the characteristics being determined by the installation requirements.

# New Trade Publications

ZEPHYR WASHED AIR SYSTEM is the subject of a series of circulars issued by the Zephyr Washed Air Co., 120 Ninth St., South, Foshay Bldg., Minneapolis, Minn. The principal feature of this system is a cabinet designed to be located against the wall and in which a downward spray of water is in operation. Air is drawn through the upper



**Cabinet of Zephyr Washed Air System, Showing Course of Air in Passing Through Spray**

opening and circulated through the cabinet by the force of the water spray. Its evaporating capacity is given as from 10 to 15 gal. of water per day, besides providing an air supply free from dust. These cabinets are made in a number of types, including one designed for use in connection with a warm-air furnace. There is also a thin model, designed to be pushed up between the walls from the basement. Other models include an In-wall and a closet type.

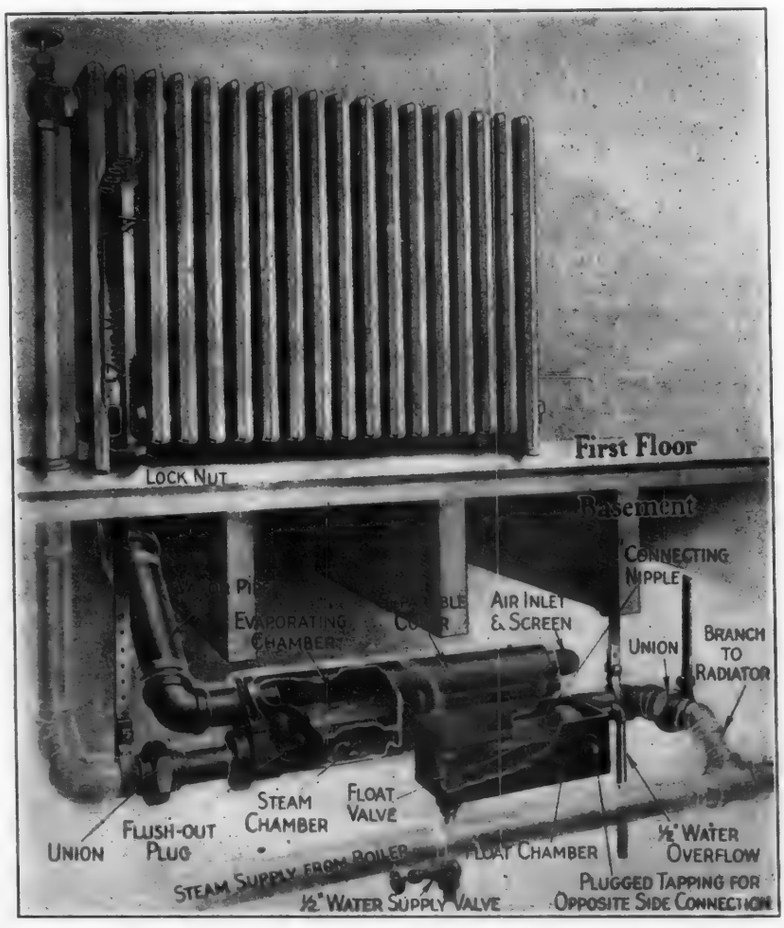
PAGE BOILERS, VOLUNTEER AND MONARCH, "for heating buildings of every description by steam, vapor and hot water, with any fuel," are presented in a new 1927 catalog (No. 53), issued by the Wm. H. Page Boiler Co., 200 Madison Ave., New York. The ratings as given, it is stated, are derived from tests made in accordance with the A.S.H. & V.E. low-pressure boiler code. Both the volunteer boilers, which are of the round type, and the Monarch water-tube boilers, which are of the sectional type, are described as the result of over 70 years' practical experience in the manufacture of heating apparatus. In connection with the Monarch smokeless boiler, a phantom view accompanying the descriptive text shows very clearly the arrangement of the auxiliary air inductor, primary and secondary combustion chambers and nipple connections. The tables of data for each series are concisely arranged for quick and easy reference. Size 3½ in. x 7 in. Pp. 104.

A PRACTICAL HUMIDIFIER FOR THE STEAM-HEATED HOME, issued by the Universal Humidifying Co., 2013 Sansom St., Philadelphia, Pa., presents the long-awaited details of the Thico humidifier which has been under development for the past two years by the same company that manufactures the Braemer humidifier. As noted in these columns at the time of the formation of the Universal Humidifying Company, the Thico humidifier was designed originally by T. H. Ireland and has been further perfected by him in collaboration with William G. Braemer and George I. Cornwall, of Hitchings & Co., Elizabeth, N. J. The device consists essentially of a cast-iron body and cover, forming two chambers, the upper separated from the lower by a relatively thin integral wall. The lower or steam chamber is threaded at both ends of 2-in. pipe connection. The upper or evaporating chamber is open at both ends, to permit air inlet and vapor tube connection.

Attached to one side of the body of the device is a cast-iron receptacle, with cover. This is the water reservoir or float chamber containing a brass float valve and float, tapped for connection of ½-in. water line. The reservoir or float chamber communicates with the water or evaporating chamber in the body of the humidifier, through a ½-in. nipple, so that the water level in both chambers is the same. The body of the evaporating chamber is also tapped and plugged to provide a flush-out opening for cleaning the evaporating chamber at the beginning of each heating season.

Above the water level in the float chamber is a ½-in. threaded opening for connection of overflow pipe, as and if necessary. The body of water in the evaporating chamber of the humidifier is very shallow, presenting an evaporating surface of 33% more square inches area than the number of cubic inches of water present.

The humidifier is usually installed in the steam pipe leading to any suitable first-floor radiator, being pitched slightly upward in the direction of steam




**Typical Installation of Thico Humidifier**

flow, so that the lower end is that at which the steam enters. Thus the steam passes through the humidifier on its way to the radiator.

The opening to the evaporating chamber, at the lower, or steam-entering end of the humidifier, is covered with a copper screen and serves as the air inlet. The opposite opening of the evaporating chamber is connected to a 2-in. pipe which is carried over and then upward through the floor to a point behind the radiator and beneath the space between the second and third sections from the steam-entering end of the radiator. The vapor tube, triangular in shape, except at the lower end where it is drawn into a cylinder, is made of non-corrosive zinc. The cylindrical end of this tube is inserted in the 2-in. pipe, at the floor line, and the triangular length is fitted into the space between the second and third radiator sections, being held in this position by means of a tension spring.

When the installation is completed the water-feed valve is opened, whereupon the float chamber and the evaporating chamber are filled with water up to the level fixed by the float valve, which thereafter automatically maintains this level, admitting water as it is evaporated.

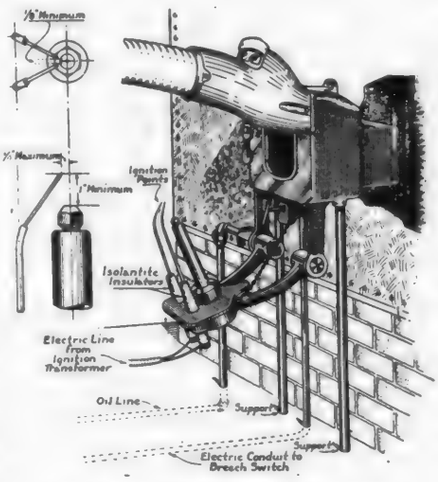
When the radiator steam valve is opened, i.e., "turned on," steam flows to the radiator *through the humidifier*, heating the water in the evaporating chamber to or nearly to the temperature of the steam itself.

As the water in the evaporating chamber of the humidifier becomes hot and begins to vaporize a "stack draft" is induced in the vapor tube.

The water-vapor, accompanied by its conveyor air, issues from the top of the vapor tube and mingles with the heated air rising from the radiator.

The normal humidifying capacity of the Thico Type A humidifier is given as sufficient for approximately 5,000 cu. ft. of space in the average home. The unit, it is stated, will evaporate from 1½ to 2 lbs. of water per hour, under average conditions. It is listed at $49.00 f.o.b. factory, Elizabeth, N. J. It weighs 80 lbs. Size of catalog, 4 in. by 9 in. Pp. 32.

THIS BOOKLET IS OUR TRAVELING SALESMAN is the caption of a publication issued by The Basel Mfg. Co., Kansas City, Mo., manufacturers of regulators, valves and other oil burner and gas burner accessories. The catalog contains a complete description, well illustrated, of the Basel Type E-2 combined hand and automatic magnetic-control heat-regulating system. This device is designed for the control of atmospheric oil burners, operating on the high-low principle. A special thermostat is used through which the oil-valve control mechanism is operated. The circular also describes other types of devices for controlling oil and gas burners which are approved by the Underwriters' Laboratories. The booklet contains 15 pages and is copiously illustrated.




**The Business End of the Wayne Burner**

## Wayne Company's Sales-Installation-Service Manual

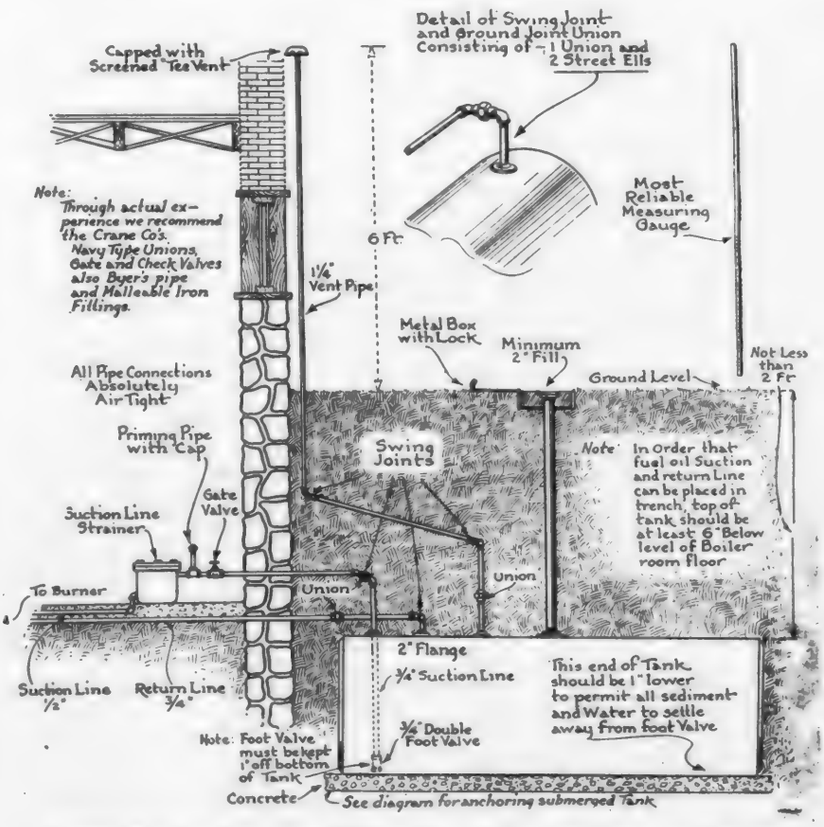
Probably the most comprehensive and voluminous oil-burner manual that has been compiled, designed to assist in sales, installation and service, is that prepared by the Wayne Company, Fort Wayne, Ind. Nearly thirty sections are required to cover the installation procedure alone, and the many illustrations are remarkably fine examples of line drawing in uniform style.

The chapters are successively devoted to the advantages of fuel-oil burning, the installation of a fuel-oil burning system, the principles of oil burning, how Wayne applies these principles, a summary of Wayne features, how the model W, Type A burner operates, fuel-oil tank installation, installation of Wayne oil burner, service procedure for Wayne burners, repair parts and schedule of dimensions.

An interesting graph has been worked out from the analysis of oil-burner fires, made by the National Board of Fire Underwriters; clear delineations show the common defects in chimney and flue construction; proper methods of tank installation are shown in detail; bricking schemes for various types of boilers and furnaces are shown; a graph permitting the proper selection of fuel nozzle-oil pressure combinations has been worked out and a number of sheets go into minute details regarding the electrical control circuits of Honeywell, Minneapolis and Mercoid control systems.

The section devoted to the installation of Wayne burners is so complete that it would appear impossible for a mistake to occur. The illustrations are exceptionally well done and the accompanying text is lucid. The entire production gives evidence of painstaking preparation.

The Wayne Company advises that it will be glad to place copies of this manual in the hands of executives of oil-burner organizations, in the hope that such practice will become general and promote mutual benefits.


Detail of Swing Joint and Ground Joint Union Consisting of — 1 Union and 2 Street Ells
Capped with Screened Tee Vent
Most Reliable Measuring Gauge
6 Ft.
Note: Through actual experience we recommend the Crane Co's. Navy Type Unions, Gate and Check Valves also Byer's pipe and Malleable Iron Fittings.
1¼" Vent Pipe
Metal Box with Lock
Minimum 2" Fill
Not Less than 2 Ft.
Ground Level
All Pipe Connections Absolutely Air Tight
Priming Pipe with Cap
Swing Joints
Note: In Order that fuel oil Suction and return Line can be placed in trench, top of tank should be at least 6" Below level of Boiler room floor
Gate Valve
Suction Line Strainer
To Burner
Union
Union
2" Flange
¾" Suction Line
This end of Tank should be 1" lower to permit all sediment and Water to settle away from foot Valve
Suction Line ½"
Return Line ¾"
⅜" Double Foot Valve
Note: Foot Valve must be kept 1" off bottom of Tank
Concrete
See diagram for anchoring submerged Tank

**Proper Plan for Installing Oil Fuel Supply Tank as Illustrated in the New Wayne Manual**

# Present Accepted Practice in Domestic Oil Burners

## Vesta. *Atomizing, Mechanical Draft, Gas-Pilot Ignition*

Previous articles in this series are:

1. *Kleen Heet, July*, 1925.
2. *Baker, July*, 1925.
3. *Kerrihard, July*, 1925.
4. *Silent Glow, August*, 1925.
5. *Aetna, August*, 1925.
6. *Caloroil, September*, 1925.
7. *Oil-O-Matic, September*, 1925.
8. *Chalmers, October*, 1925.
9. *Hart, October*, 1925.
10. *Sun, October*, 1925.
11. *Rayfield, November*, 1925.
12. *A. B. C., November*, 1925.
13. *Electrol, December*, 1925.
14. *Grant, January*, 1926.
15. *Nu-Way, January*, 1926.
16. *Wayne, February*, 1926.
17. *May, February*, 1926.
18. *Ray Rotary, March*, 1926.
19. *Super Oil Heator, May*, 1926.
20. *Nokol, July*, 1926.
21. *Johnson, August*, 1926.
22. *Arrow, September*, 1926.
23. *Safe Fire, October*, 1926.
24. *Sword, November*, 1926.
25. *Hardinge, January*, 1927.
26. *Petro, February*, 1927.
27. *Sundstrand, March*, 1927.
28. *Northern, May*, 1927.

## 29. Vesta

FOLLOWING the design of time-tried industrial burners of the air-atomizing type, a domestic burner is marketed under the trade-name Vesta by J. S. & J. F. String, Inc., of Newark, N. J. All sales are handled by the Combustion Service Corporation, New York.

The background of this burner is interesting in that the two brothers constituting the firm were, for years, representatives of W. N. Best, well known as one of the earliest of the pioneers in industrial oil burning. Having passed through the development of the industrial burner, their attention was directed to the domestic field about five years ago by requests from clients for such equipment.

In designing a burner for universal installation in house-heating boilers it was decided to stick to well-tried principles, making only changes necessitated by differences in requirements. This led to the design of a nozzle incorporating a characteristic claimed by W. N. Best to lie at the foundation of a successful burner—that of producing a flame particularly suited to the shape of any combustion chamber that might be encountered in practice. This nozzle, then, forms the nucleus around which the burner is built.

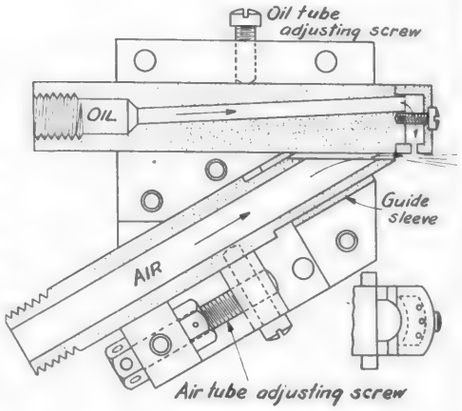
There are two units involved, the first a motor-driven air pump and the second the nozzle with the control and ignition devices. The air-compressor unit may be placed where convenient; the other unit is placed in front of the boiler or furnace so that the nozzle fires through the ash-pit door frame, into which is set a special refractory brick with flaring hole for the jet.

### MANUFACTURERS BELIEVE DAILY BURNER INSPECTION IS DESIRABLE

An essential part of the Vesta system is the service oil-tank, which invariably is buried beneath the burner. This is comparatively a small tank, holding only enough oil for two days of extreme weather. Oil is drawn to it by a vacuum produced by the blower unit, under manual control. In other words the manufacturer believes in having the burner visited once a day and for this reason makes it necessary to refill the service tank daily. The service tank with only a short pipe to the burner, insures the storage of comparatively warm oil with little possibility of fuel failure, and in having only top openings to the service tank and no oil pump, it is impossible to flood the burner or to get oil on the floor.

In order to provide for those who might want a burner requiring no attention whatsoever, an oil pump will be supplied, pumping to a reservoir on the burner with discharge of surplus oil to the storage tank. In working out this system a valve without stuffing-box was designed, with the moving member a cam-shaped shoe moving in a circle over a brass surface in which are two 3 32-in. holes. The shoe slides entirely over one hole to close the valve, and only partially over it for a less flow; the other hole furnishes the outlet from the valve.

The motor-blower unit consists of a 1/6-H.P. single-phase or direct-current motor, direct connected to a blower.



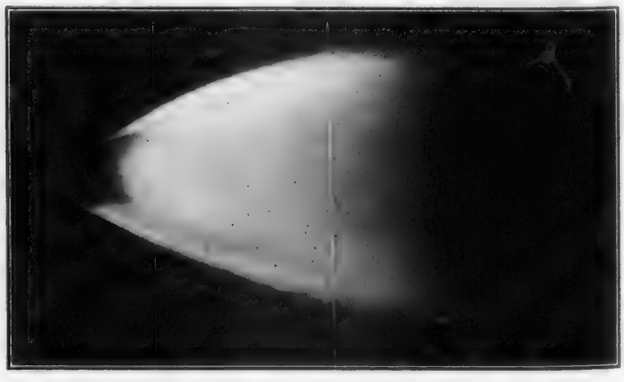

**Cross-section of Vesta Nozzle**

This unit is lubricated from a reservoir, and requires filling but two or three times a season.

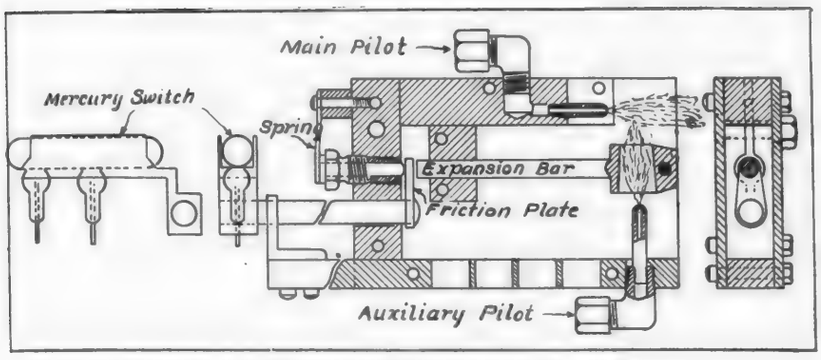
### SERVICE TANK MANUALLY OR AUTOMATICALLY FILLED

A four-way hand-operated valve controls the functioning of the burner. For an initial start the valve is so set that the suction of the blower is connected to the service tank and this tank is connected to the fuel line from the storage tank. The blower motor is then started by a hand switch and the suction of the blower creates a vacuum in the service tank, drawing oil from the storage tank. When the service tank is filled to a predetermined level,

**Looking Down on Contracted Vesta Flame for Long, Narrow Combustion Chamber**



**Looking Down on Flared Vesta Flame for Shallow or Circular Combustion Chamber**




**Detail of Gas Pilots and Safety Device, Vesta Burner**

a balsa-wood float operates to shut off the valve in the fuel supply line. The motor is then stopped, the four-way valve reset, and the burner is ready for operation.

The oil is atomized with air at a pressure of about 1½ lbs. per square inch, and a weighted safety valve on the blower is set when the burner is installed.

The manufacturers maintain that in doing away with a small-capacity oil pump, an anti-siphon valve, oil shut-off and other related mechanism, the system is simplified to a marked degree without sacrifice of any desired characteristic. Furthermore, the use of air pressure for the fuel supply insures a uniform feed without pulsation.

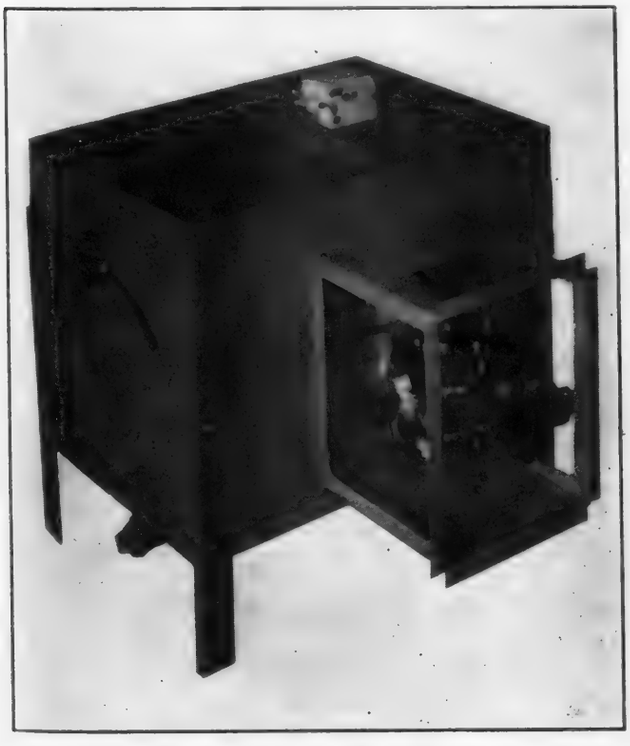
The burner unit is installed in front of the boiler and consists of the nozzle, two gas pilots, pilot switch, automatic gas valve, oil-regulating valve and motor-control switch—all enclosed in a heavy-gauge enameled metal housing.

The oil-control valve of the flat, regrinding, disc type, is fastened to the inside of the casing, and controls the oil flow from service tank to nozzle. It is actuated by an arm with a crank handle at the end, protruding through a quadrantal slot cut in the casing. A knurled nut on the handle can be tightened against the casing to maintain the valve opening as desired. This valve setting is determined when the burner is installed. A strainer is interposed between the valve and service tank.

### ATOMIZING NOZZLE ADJUSTABLE FOR WIDE RANGE OF FLAME SHAPES

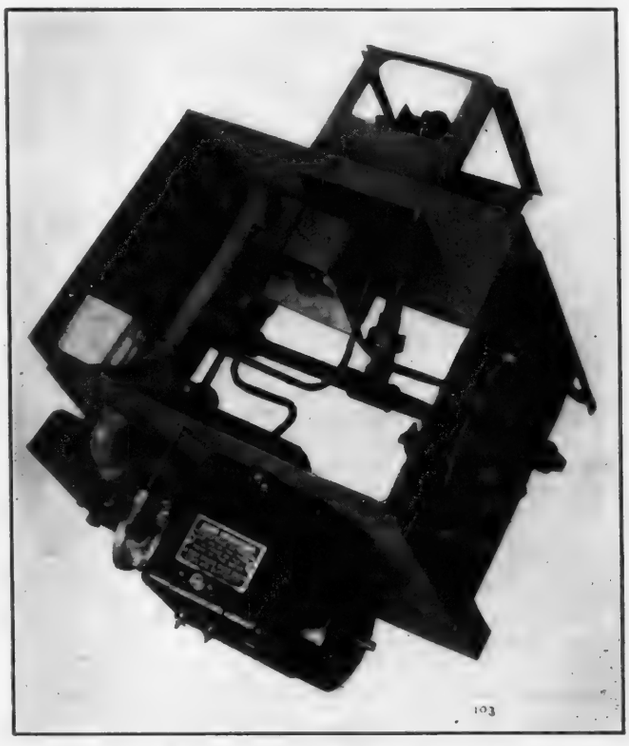
The nozzle, which probably is the most distinctive element of this burner, consists of two parts—the oil nozzle and the air tube. Each is manufactured from square brass bar, the workmanship being exceptionally high-class. There are two side-plates to the burner assembly, the oil and air tubes sliding in guides between them. The oil nozzle, with a compression fitting at the rear end, slides in horizontally. The oil passage is drilled at a slight angle so that oil will drain back into the oil line rather than out through the nozzle orifice. There are three holes forming the nozzle, drilled into a cap to the bar from the bottom, so that the tendency of the oil is to drop from them. The air tube enters the nozzle unit from the under side, its axis making an angle of about 30° with the oil tube. It is turned down to a circular form on the front end, fitting snugly into a sleeve which acts as a guide. By means of a screw movement the air tube can be moved backward or forward so that the opening between its outer tip and the oil tube can be changed. The control is of micrometer accuracy.

Two small projections on either side of the air-tube tip and the sliding action of the tube make it possible to change the shape of the flame from almost a perfect cone to a flat horizontal fan-like area. With control over the length of the flame and its shape, the setting can be made to conform to any size or shape of combustion chamber likely to be encountered in the field. It is this flame-shape control that is claimed to account for high-efficiency installations in any kind of boiler. The nozzle fires through a refractory block having a flaring hole large enough to permit taking in a small amount of secondary air. The air flow keeps the nozzle so cool that it can be handled while in operation. This design prevents carbonization at the nozzle orifices, and it is stated that burners frequently operate through an entire heating season without requiring cleaning.



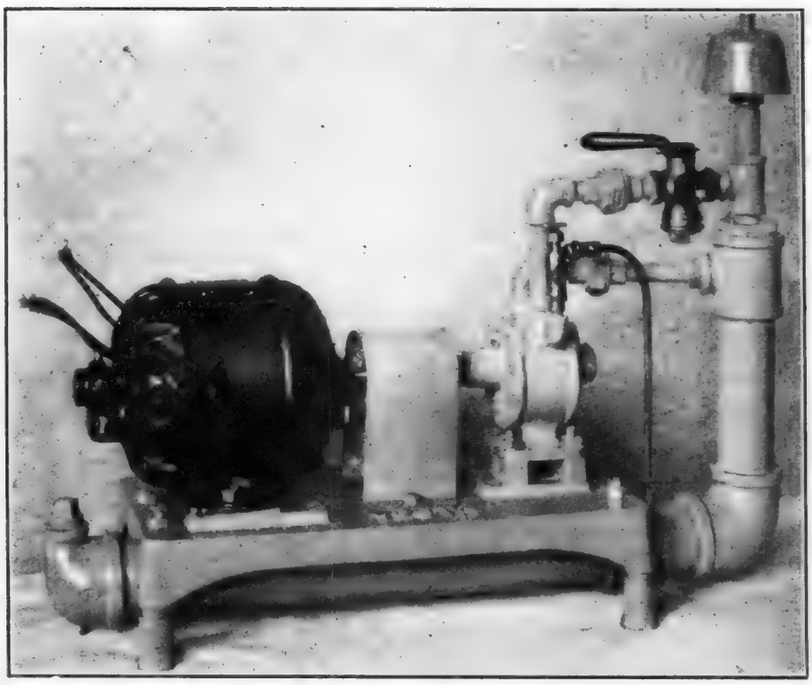
**Vesta Burner Unit with Top Removed**

The nozzle is shown at the right front, with the air line entering from an angle. At the left is the quadrant handle controlling the oil valve.



**Vesta Burner Unit with Cover Removed**

In the foreground is seen the Honeywell motor control switch and, in the upper central part, the tilting mercury switch used as a safety device.



**The Vesta Motor-Driven Blower Unit**

IGNITION SYSTEM EMPLOYS TWO GAS PILOTS WITH UNIQUE SAFETY

The ignition system is notable in many ways. There is a primary gas pilot continuously burning, the flame being but ½ in. high. The design and operation of the safety device is unique, simple and positive. A glass-tube mercury switch is so fixed to a rocker arm that it tilts if the arm is not held in horizontal position. The safety device is a rod of aluminum about ¼ in. in diameter and 4 in. long with a considerably enlarged rectangular head. The head is held fast to the frame, and the other end, when the rod is hot, presses against the mercury-switch arm so that it is held in horizontal position. There is a ½ in. vertical hole in the head of this aluminum member and the constantly-burning gas pilot flame is set in this hole so that the tip of the flame extends just above the aluminum. Under these conditions the aluminum member is kept hot by the radiant heat from the flame and in this case the elongation of the bar furnishes the friction to hold the tilting switch in place. If through any accident, the pilot flame is extinguished, the rod cools and shortens, the pressure against the tilting arm is removed and the tube tilts, cutting off current from the blower motor. A micrometer adjustment is provided for regulating the pressure of the aluminum member on the tilting arm and this is adjusted when the burner is installed.

The operating pilot has a horizontal flame, its tip being just above and behind the head of the aluminum bar. When the burner is started, this pilot is supplied with gas, which lights from the primary flame and flares out into the cone of atomized oil. This flame burns continuously when the burner is in operation so that there practically is no chance for oil to be ejected into the combustion chamber without ignition taking place.

As the Vesta domestic burner is made up of two units, it is possible to fire any boiler up to 5000 sq. ft. rating by changing the motor and blower size, or, if necessary, by making use of two nozzles, supplied from one blower unit. The equipment, therefore, is very flexible in this regard.

The type D (domestic) Vesta burner is listed by the Underwriters for oil fuels not heavier than 32° A.P.I. and is approved by the Board of Standards and Appeals of New York City. It is made in four sizes, having capacities of 800, 1300, 2000 and 3600 sq. ft. of net standing steam radiation and the equivalent in water radiation.

## Canadians May Form Oil Burner Association

In line with the suggestion made at the Buffalo convention of the American Oil Burner Association, that a similar organization in Canada would help materially to stimulate business in this field and to bring about more ethical methods, those engaged in manufacturing and selling oil burners in the Dominion are considering the advisability of such a move. In view of the fact that President Lionel L. Jacobs, of the American Oil Burner Association, is a resident of Toronto, and thoroughly familiar with the oil burner situation in Canada, it is probable that this association, if formed, will be patterned after the American organization and will develop rapidly because of the background already built up.

## C. F. Olmstead Returns to Former Associates

C. F. Olmstead has resigned his position as technologist of the American Oil Burner Association and has returned to the Mahr Mfg. Co., Minneapolis, as sales service engineer. Before becoming identified with the association, Mr. Olmstead was chief engineer for the Mahr Manufacturing Company.

**A Typical Vesta Installation**

Home Bank and Trust Company Building, Chicago
*Architects*, K. M. Vitzthum & Company *Heating Contractor*, E. S. Volk

**The Powers VAPOR DISC Thermostat**

Gives true gradual control. Uses only ten per cent of the compressed air required by other thermostats. Gives twenty to thirty years of ACCURATE service without frequent adjustments. Costs more than others. Its uninterrupted service year after year makes it worth more, and it really costs less in the end.

# "The Best costs less in the end"

Systems of automatic temperature control that need yearly adjustment and other repairs are not only annoying, but waste fuel and cause much discomfort.

These troubles and the "service" bills, which so often come with systems of temperature control whose first cost is lower than POWERS, will not be known by the management of the Home Bank and Trust Company Building, for in selecting Powers Control for the heating and ventilating equipment of this splendid new building, the architects have provided their client with a system that will give many years of ACCURATE and DEPENDABLE service without maintenance expense.

**Our book, "The Elimination of Heat Waste," shows ample evidence to support the above claims. May we send you a copy?**

## THE POWERS REGULATOR CO.

*36 years of specialization in temperature control*

2718 Greenview Avenue, Chicago

Atlanta, Baltimore, Boston, Buffalo, Butte, Mont., Charlotte, N. C., Cincinnati, Cleveland, Denver, Des Moines, Detroit, El Paso, Houston, Indianapolis, Kansas City, Los Angeles, Milwaukee, Minneapolis, Nashville, New Orleans, New York, Philadelphia, Pittsburgh, Portland, Rochester, St. Louis, Salt Lake City, San Francisco, Seattle

CANADIAN OFFICES

Toronto, Montreal, Halifax, Winnipeg, Calgary, Vancouver

(3523A)

TABLE OF CAPACITIES OF STANDARD JENNINGS HEATING PUMPS

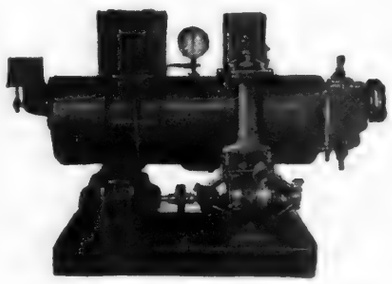
| Size | Equivalent Direct Radiation sq. ft. | Diameter Standard Orifice Used For 10 inch Vacuum inches | Air Capacity cu. ft. per min. | Water Capacity At 180° F Against 10 lbs. Pressure gal. per min. | Actual Motor H.P. For Delivering Water Against 10 lbs. Pressure | R.P.M. And Motor H.P. 10 lbs. | | 20 lbs. | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | R.P.M. | H.P. | R.P.M. | H.P. |
| T | 2,500 | 7–64 | 3 | 4 | 33 | 3450 | 1/3 | 3450 | ½ |
| M | 5,000 | 7–64 | 3 | 8 | .75 | 1800 | 3/4 | 1800 | 1 |
| A | 8,000 | 9–64 | 5 | 11 | .9 | 1800 | 1 | 1800 | 1½ |
| B | 16,000 | 3–16 | 9 | 22 | 1.4 | 1800 | 1½ | 1800 | 2 |
| C | 26,000 | 1–4 | 15 | 35 | 2.0 | 1800 | 2 | 1800 | 3 |
| D | 40,000 | 9–32 | 19 | 60 | 2.8 | 1200 | 3 | 1800 | 5 |
| E | 65,000 | 3–8 | 34 | 90 | 3.9 | 1200 | 5 | 1800 | 7½ |
| F | 100,000 | 1–2 | 52 | 140 | 7.0 | 1800 | 7½ | 1800 | 10 |
| G | 150,000 | 9–16 | 90 | 200 | 9.8 | 1150 | 10 | 1150 | 15 |
| H | 300,000 | Two 9–16 | 180 | 400 | 14.0 | 850 | 15 | 1720 | 20 |

# Jennings *rated* capacity is also *actual* capacity

The table above gives, in columns 4 and 5, the air and water capacities of the several standard sizes of Jennings Vacuum Heating Pumps recommended for the equivalent direct radiation shown in column 2.

These are the *rated* capacities. And also the *actual* capacities. In other words, they are the capacities which the several sizes of Jennings Pumps are guaranteed to give, while maintaining a 10 inch vacuum in the return line at the pump, and at the same time delivering the full rated quantity of water against 10 or 20 lbs. pressure.

Data on equipment having larger capacities or discharging against higher pressures gladly furnished on request.



*Motor-Driven Jennings Vacuum Heating Pump, for withdrawing condensation and air from the return line steam heating system, discharging the air direct to atmosphere without back pressure, and returning the water to the boiler.*

**NASH ENGINEERING COMPANY**

**SO. NORWALK** **CONNECTICUT**

UNITED STATES: Atlanta, Birmingham, Boston, Buffalo, Chattanooga, Chicago, Cleveland, Dallas, Denver, Detroit, Indianapolis, Kansas City, Memphis, Miami, Minneapolis, New Orleans, New York, Omaha, Philadelphia, Pittsburgh, Portland, Richmond, St. Louis, Salt Lake City, San Francisco, Seattle, Tampa, Washington, D. C. CANADA: Montreal, Toronto and Vancouver. EUROPE: London, England, Norman Engineering Co. Brussels, Belgium, and Amsterdam, Holland, Louis Reijners & Co. Oslo, Norway and Stockholm, Sweden, Lorentze & Wettre.

# Jennings Pumps

RETURN LINE AND AIR LINE VACUUM PUMPS CONDENSATION AND CIRCULATING PUMPS

# Trade and Miscellaneous Notes

## Coming Events

**June 28-30, 1927.** Semi-annual meeting of the American Society of Heating and Ventilating Engineers, at White Sulphur Springs, W. Va.

**October 12-16, 1927.** Ninth annual convention of the American Gas Association at Chicago, Ill. Headquarters at the Hotel Stevens.

## Miscellaneous Notes

**Gas Products Association,** 140 South Dearborn St., Chicago, composed of manufacturers of oxygen, acetylene, hydrogen, welding and cutting apparatus, etc., has completed two reels of welding and cutting films illustrating the oxy-acetylene welding and cutting processes. A limited number of prints of these films are available to organizations desiring to show them.

**Building Operations for April, 1927,** as reported by the F. W. Dodge Corporation, showed an increase of 6% over 1926. The figures for 37 states are $604,390,700. Of this amount 44% was for residential buildings, 19% for public works and utilities, 13% for commercial buildings, 7% for industrial buildings, and 6% for educational buildings.

**Lewis E. Pierson,** chairman of the American Exchange-Irving Trust Company, New York, was elected president of the United States Chamber of Commerce, at its annual meeting in Washington, May 5. Judge Edwin B. Parker, of Houston, Tex., and Washington, D. C., was named to fill a newly created position of chairman of the board of directors.

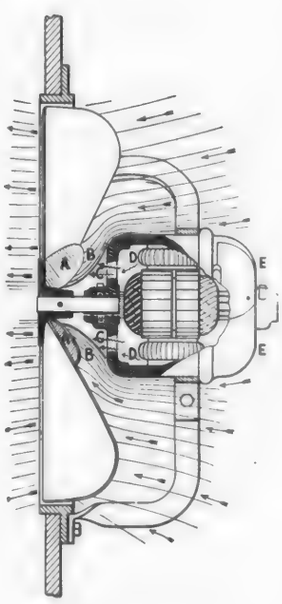
**American Welding Society,** at its annual dinner in New York, April 28, announced the donation of an award, the gift of Samuel Wylie Miller, to be presented by the society annually in appreciation of work of outstanding merit in advancing the art and science of welding. The award is a gold medal, which will be known as the Miller Medal.

**Audit Bureau of Circulations** has elected S. E. Conybeare, advertising manager of the Armstrong Cork Co., Lancaster, Pa., and president of the Association of National Advertisers, a member of its board of directors.

**Clarence M. Woolley,** chairman of the board of directors of the American Radiator Company, has been named a director of the General Electric Company. Mr. Woolley is also a director of the General Motors Corporation, a director of the Federal Reserve Bank of New York, a director of the Gold Dust Corporation, and a director of the Texas Gulf Sulphur Company.

**Detroit Association of Sanitary and Heating Contractors,** the local chapter of the National Association of Plumbing and Heating Supply Salesmen, and others connected with the industries, at a meeting on May 26, discussed cooperative merchandising. The feature of the meeting was an address by Mr. Wanger, of the Woodward-Wanger Co., Philadelphia, on "Selling as Applied to the Plumbing and Heating Industry."

**National Trade Extension Bureau** will exhibit a model plumbing and heating store at the National Association of Master Plumbers' Convention, to be held in Minneapolis June 20-24. This exhibit will be 75 ft. long and 25 ft. wide, and promises to be the most complete exhibit of this kind ever conducted in the heating industry. The


Patented

# Protecting the Motor

TESTS show that passage of a current of air through the motor causes corrosion and contamination of motor windings.

Autovent Fan Motors are definitely insured against contamination because the front end is securely closed (E) by removable inspection covers.

The radiation cooling feature is accomplished by patented **Centripetal Vanes** (A) on the fan wheel hub.

As the wheel spins around these vanes cause the air currents to speed up and converge at the axis, thereby carrying away the heat from the fan end of the motor (D).

A **protected** motor will always give satisfaction.

***Estimates and prices cheerfully furnished by our Engineering Department.***

**AUTOVENT FAN & BLOWER CO.**

**730-738 W. Monroe St., CHICAGO**

ENGINEERS IN ALL PRINCIPAL CITIES

AUTO [Automatic] VENT [Ventilation]

[GUARANTEED]

two display windows will be actual size, and will be trimmed each day of the convention. The most satisfactory and economical lighting fixtures and display material will be used to show how attractive and appealing a display window can be made with very little expense.

**Carnegie Institute of Technology,** Pittsburgh, Pa., at its graduating exercises June 7, was addressed by Harvey Wiley Corbett, of the architectural firm of Helmle and Corbett, New York, who delivered the commencement oration. Mr. Corbett was a speaker at one of the recent meetings of the New York Chapter of the A.S.H. & V.E.

**National Pipe and Supplies Association,** whose 18th annual convention was held in Pittsburgh, May 10-11, paid particular attention to what were described as unsound business tactics on the part of wholesalers and manufacturers. It was brought out that the desire for volume had led to an abnormal extension of actual marketing areas, resulting in an overlapping of effort of the manufacturers over the wholesalers and vice versa. New officers are: President, W. C. Hanson, E. G. Schafer Co., Washington, D. C.; first vice-president, C. F. Harvey, A. Harvey's Sons Mfg. Co., Detroit; second vice-president, J. H. Borton, Hajoca Corp., Philadelphia; secretary-treasurer, George D. McIlvaine. Speaking for the boiler and radiator business, Charles K. Foster, vice-president of the American Radiator Company, stated that the conditions were about the same as last year, orders are frequent but not large. He expected this year to be as good in volume and as good or better in profits as last year. A proposal made by Theodore Ahrens for raising money to be used in furthering trade extension work and in inaugurating a national publicity campaign was referred to the association's executive committee.

**Stanwood Corp.,** Covington, Ky., is featured in an article that appeared in a recent Sunday issue of "The Kentucky Post," of Cincinnati. This is one of the series of articles growing out of a survey made by the Covington Industrial Club, and tells an interesting story of the origin and development of this corporation, which is known as manufacturer of the Stanwood smokeless boilers.

**National Trade Extension Bureau,** it has been announced, will not move its headquarters from Evansville to St. Louis at this time. Plans were made earlier in the year for such a move, but due to the expense involved it has been deferred for the present.

**Baltimore Better Homes and Building Exposition,** held in Baltimore, April 23-30, embraced a number of heating products including those manufactured by the Abram Cox Co., Phi'adelphia, Clow Gasteam Radiator Co., Chicago, Union Radiator Co., Johnstown, Pa., L. J. Mueller Furnace Co., Milwaukee, and the Baltimore Unit Heating Corp., Baltimore.

**Department of Public Works,** State of Washington, has arranged to install an electric heating system in a Seattle home, and will keep a thermographic record of warming the residence under all conditions, to determine exactly how much current is required for the service and its cost.

**Building Trades Employers Association,** now located at 30-34 West 33rd St., New York, has leased the 25th floor of 2 Park Avenue.; the building now rising on this site will be known as the New York Builders' Exchange. The officers of the association are: President, Walter S. Faddis; first vice-president, A. J. Rosenthal; second vice-president, John J. Grace; treasurer, William Joshua Barney, and secretary, Harry A. Moss.

**Edwin S. Hallett,** chief engineer of the St. Louis Board of Education, was one of the speakers at the recent annual convention of the National Education Association, in Dallas, Tex. Mr. Hallet addressed the superintendents' division on "Producing and Maintaining Optimum Conditions in Schoolrooms."


PECCO

UNIT HEATERS

HEAT—*where you want it!*

*FOR USE IN:*

Wood Working Plants
Garages & Auto Sales
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Laundries
Drying
Shoe Factories
Foundries & Forging Plants
Apartment House Garages
Theatres & Gymnasiums
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Printing Plants
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The Pecco Unit Heater can be equipped with outlets so that warm air can be delivered in as many different directions as desired. The amount of warm air from each outlet can be regulated so as to meet every requirement.

The heating coils, due to their position in the upper part of the heater, make it much easier to run return lines back to the boiler.

Pecco Heaters are easy to install, portable in every sense of the word, and simple and sturdy in construction. Their great capacity and adaptability have established Pecco Heaters as the standard equipment wherever efficient heating and ventilating is desired!

*This external view shows some Pecco Unit Heater features. Note that the cold air intake fan is located where it belongs —near the floor at the cold air level.*

*Write for Free Book "Pecco Unit Heaters."*

***Heat With Unit Heaters!***

PECCO, INCORPORATED, 2980 North Market Street, St. Louis, Mo.

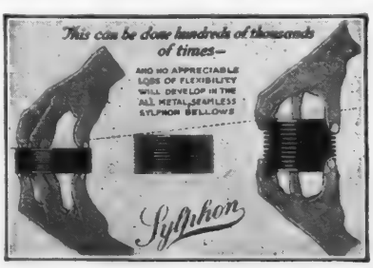
*No. 46 Sylphon Hot Water Damper Regulator. Controls from 130° to 200° F. Length of bulb 1 inch; threaded 1-inch pipe size. May be screwed into boiler, laundry heater or garage heater.*

*Cut open view of No. 45-A Sylphon Hot Water Damper Regulator. Controls from 120° to 220° F. Length of bulb 2 inches; threaded 2-inch pipe size. Installed in a Y or screwed into boiler.*

*The well known Sylphon Bellows is the diaphragm of every genuine Sylphon Damper Regulator. It is drawn and formed from a single sheet of metal, without seam or joint throughout its entire length, and is the most flexible, sensitive and durable expansion unit known to engineering science.*

# Hot Water Damper Regulators

Every hot water house heating boiler should be equipped with automatic damper regulation, just as steam boilers are—to save coal and help produce uniform heating. But there is a great difference in the reliability, responsiveness and durability of damper regulators. The diaphragm is the heart and life of any damper regulator; and if it is made of rubber, solder or other perishable materials you know it will not long function satisfactorily. You can be sure of the utmost in quick response to slight changes in temperature, smooth, dependable action, and long-life regulation, if you install either of the above Sylphon Damper Regulators on your hot water heating jobs.


This can be done hundreds of thousands of times—
AND NO APPRECIABLE LOSS OF FLEXIBILITY WILL DEVELOP IN THE ALL METAL SEAMLESS SYLPHON BELLOWS
Sylphon

***Insist upon the genuine—refuse imitations. Ask for Bulletin WDR-5.***

## The Fulton Sylphon Company

*Originators and Patentees of the Sylphon Bellows*

Knoxville, Tennessee, U.S.A.

**SALES OFFICES IN:** New York Chicago Detroit Boston Philadelphia
and all the Principal Cities in U. S.

**European representatives:** Crosby Valve & Engineering Co., Ltd. 41-42 Foley Street, London, W. 1, England

**Canadian representatives:** Darling Bros., Ltd. 120 Prince Street, Montreal, Canada

**Washington, D. C.**—Announcement is made that sentences in the case of eight members of the former Sanitary Potters' Association, who were convicted of violating the Sherman anti-trust law, have been suspended at the instance in part of counsel for the government. In suspending sentences Justice A. N. Hand stated that "in view of the decision of the Supreme Court, it seems quite intolerable that men should be sent to jail for an act which confessedly did no harm, and, in the economic conditions existing at the time, could have done no harm to public interests." The executives affected are: E. S. Aitkin, Trenton Potteries Company, A. M. Maddock, Thomas Maddock's Sons Company, R. E. Crane, Eljer Company, Arthur Plantier, Sanitary Earthenware Specialty Company, George C. Kalbfleisch, Standard Sanitary Mfg. Company, J. E. Wright, Wheeling Sanitary Mfg. Company, Phillip J. Flaherty, Lambertville Pottery Company, William B. Maddock, John Maddock & Sons Company.

**Second Pan-American Standardization Conference** meeting, held in Washington, D. C., early in May, had as its program the unification of commercial standards of all the American republics. The sessions followed those of the Pan-American Commercial Conference, which also met in Washington.

**Southwestern Trade Golf Association** has elected the following officers for 1927: President, J. C. McDonald, U. S. Radiator Corp.; vice-president, R. L. Dawson, R. L. Dawson Plumbing Co.; secretary and treasurer, E. A. Cline, General Heating Supply Co.; chairman handicap committee, I. L. Roark, I. L. Roark & Co.

**Fundamental Principles** to be taken in account by manufacturers in the proper treatment of overhead costs, are set forth in a pamphlet entitled "The Evolution of Overhead Accounting," issued by the Department of Manufacture of the Chamber of Commerce of the United States.

**Bloomington, Ill.**—The three R's, fundamentals of education in the little old red schoolhouse, have their counterpart in the three B's, fundamentals of living in the American house of to-day, judging by figures just compiled by the Williams Institute of Heat Research. From 1923 to 1925, according to manufacturing census reports, the production of brooms fell off 17%. In the same period the commercial baking of bread increased 12% and the manufacture of oil burners for domestic heating purposes grew 68%.

**Underwriters' Laboratories,** Chicago, announce the assignment of George F. Moffitt, Jr., graduate of Armour Institute of Technology, to the Laboratories' Gases and Oil Department as assistant engineer.

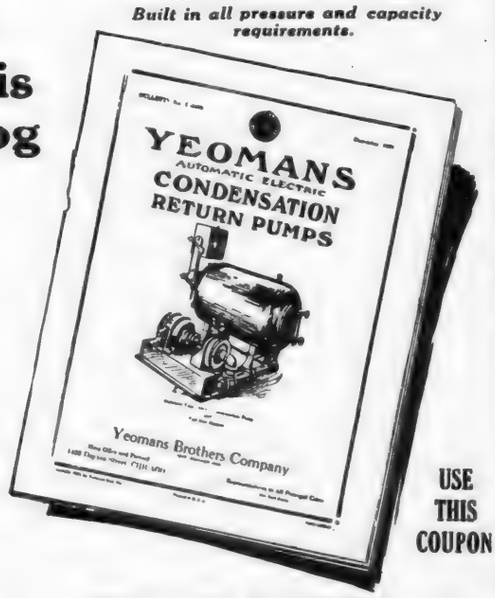
**J. F. McIntire,** vice-president of the United States Radiator Corp., Detroit, Mich., has been spending several weeks abroad in visiting England, France, Belgium and Germany.

**Dr. L. E. Young** has been elected vice-president of the Pittsburgh Coal Company in charge of operations. Dr. Young has for eight years been associated with the Union Electric Light and Power Co., St. Louis, and was general manager of the Union Colliery Company at St. Louis.

**Julius L. Hecht,** vice-president in charge of operation for the Public Service Company, Chicago, is the newly elected president of the Illinois State Electric Association. Mr. Hecht for many years has been prominent in activities in the Western Society of Engineers and in the National District Heating Association, of both of which he is a past president. He is also a member of the American Society of Mechanical Engineers, the American Institute of Electrical Engineers and the Engineers' Club of Chicago.


**Send for this Catalog NOW**

*NOISELESS RUGGED*
*Built in all pressure and capacity requirements.*

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**Types**
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USE THIS COUPON

**YEOMANS BROTHERS CO.**
*Representatives in principal cities*
**1421 Dayton St., Chicago, Ill.**

*Please send catalog:*

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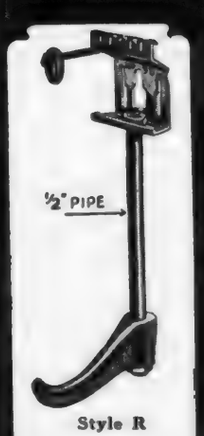
**E Z**
**RADIATOR HANGER**

We can ship from stock E-Z Hangers suitable for *All* makes of the new Tube Type Radiators.



Style R

**HEALY-RUFF CO.**
772 Hampden Avenue
ST. PAUL, MINN.

# *Improved* Asbestocel

IN Improved Asbestocel long life is added to high efficiency because corrugations run crosswise as well as lengthwise. Besides breaking up the long air channels into numerous dead air pockets, these cross corrugations give greater strength.

JOHNS-MANVILLE CORPORATION,
292 Madison Ave. at 41st St., N. Y. C.
*Branches in all large cities*
Canadian Johns-Manville Co., Toronto, Ont.

# JOHNS-MANVILLE

## Manufacturers' Notes

**W. D. Cashin Co.,** 35 Hartford St., Boston, Mass., announces the appointment of George W. Hopkins, 211 Ross St., Pittsburgh, Pa., as exclusive distributor in the Pittsburgh and western Pennsylvania territory, for Thermoflex specialties for vapor and vacuum heating and Thermoflex automatic boiler feeders.

**Detroit Stoker Co.,** Detroit, Mich., announces the appointment of A. Kastello as district sales representative for eastern Canada and Montreal, Quebec, territories, with headquarters at 915 New Birks Bldg., Montreal.

**Economy Pumping Machinery Company** has taken possession of its new plant at 3431 West 48th Place, Chicago.

**New Plant of the Economy Pumping Machinery Company, Chicago**

The plant is of brick and steel construction, 100 ft. wide by 200 ft. long. Of particular interest to pump users is the testing and experimental laboratory which has been established at the plant. The test tank is of sufficient size to handle pumps of capacities up to 15,000,000 gal. per 24 hours. A large number of independent electrical test boards are provided for testing pumps of all sizes simultaneously up to 200 H.P. With its new facilities the company will be equipped to handle a large increase in business and ample ground is available for future extension.

**Buckeye Blower Co.,** Columbus, O., announces that L. H. Williams has been appointed district manager of the Cleveland office, with headquarters at 204 Plymouth B'dg. Mr. Williams was formerly Cleveland representative of The Herman Nelson Corp., Moline, Ill.

**Perfection Stove Co.,** Cleveland, O., announces that Perfection kerosene-burning water heaters, now are being marketed only through heating and plumbing supply jobbers. These formerly were sold direct to the retailer, and comprise four models, which include one and two-burner heaters.

**International Heater Co.,** Utica, N. Y., has opened an office in Room 35, 27 State St., Boston Mass. It will be in charge of D. W. Boynton and J. W. Briggs. Automobile truck delivery between Boston and the company's warehouse in Nashua, N. H., has been established.

**Jenkins Bros.,** New York, announces the appointment of Joseph E. Hodgkins as manager, and Anthony D. Weber, as assistant manager, of the New England branch, with headquarters at 524-530 Atlantic Ave., Boston, Mass. John D. Stiles, after 40 years of service with the company, the last 30 years as manager of the New England branch, is transferred from the active to the retired list, but retains his interest in the company as one of its directors.

**National Regulator Co.,** 2301 Knox Ave., Chicago, announces that Frank C. Gibbs has been appointed eastern manager of the company, with offices at 166 Lexington Ave., New York.

**Blower Systems Corp.,** Rochester, N. Y., announces that George G. Dobson, formerly with the engineering department of the Eastman Kodak Company, has joined its staff, and is specializing on industrial problems involving the conditioning and handling of air.

**C. T. Hogue,** San Angelo, Tex., who has the state agency for the James P. Marsh Co., manufacturers of heating specialties, announces the opening of the Dallas office of the company, a branch of the local agency. This new office, located at 935 Allen Building, will be in charge of J. P. Greenwood, former state engineer of Texas.

**United States Radiator Corp.,** Detroit, Mich., announces the resignation of Charles P. Hackett as Philadelphia territory manager. D. E. Welsh, formerly connected with the general sales office of the company in Detroit, has been appointed to succeed Mr. Hackett.

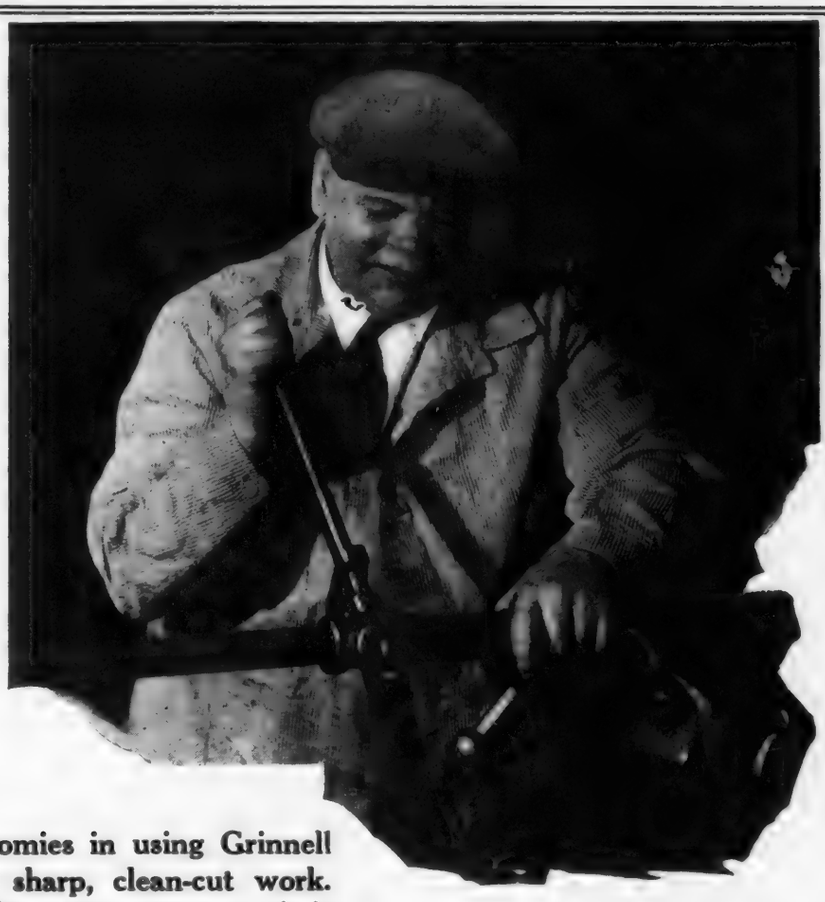
**Merco Nordstrom Valve Co.,** Oakland, Calif., is building a new factory at the corner of 24th and Peralta Streets, to be devoted exclusively to the manufacture of plug valves for the petroleum, gas and other industries. Heretofore the valves have been manufactured on the Atlantic seaboard and with two factories operating the company will be able economically to serve national trade. The company is a subsidiary of The Merrill Company, and its officers include: President, Charles C. Broadwater; vice-president, Sven Johan Nordstrom; secretary and treasurer, Herbert S. Shuey. Directors, in addition to the officers, are: Charles W. Merrill, president of The Merrill Company, and Louis D. Mills, consulting engineer of The Merrill Company.

**Monitor Boiler Co.,** Philadelphia, has opened a New York City office at 31 East 21st Street. S. B. Rigby is manager.

*Jack:* "Now that we've got the plagued system finished, I wonder how many joints we'll have to replace when we test it out."

*Old Timer:* "Don't worry, boy. They sent us Grinnell Fittings this time. Their threads are right."

*The Old Timer Knows*



One of the big economies in using Grinnell Cast-Iron Fittings is sharp, clean-cut work. Many a time, when the water, steam or air is turned on not a single section of pipe has to be backed out to replace a leaky fitting. See for yourself. Try out some Grinnell Fittings on one job and you'll be quick to note the difference. If your own jobber doesn't stock them, write us for the name of the nearest distributor. Address your inquiry to Grinnell Company, Inc., 280 West Exchange St., Providence, R. I.

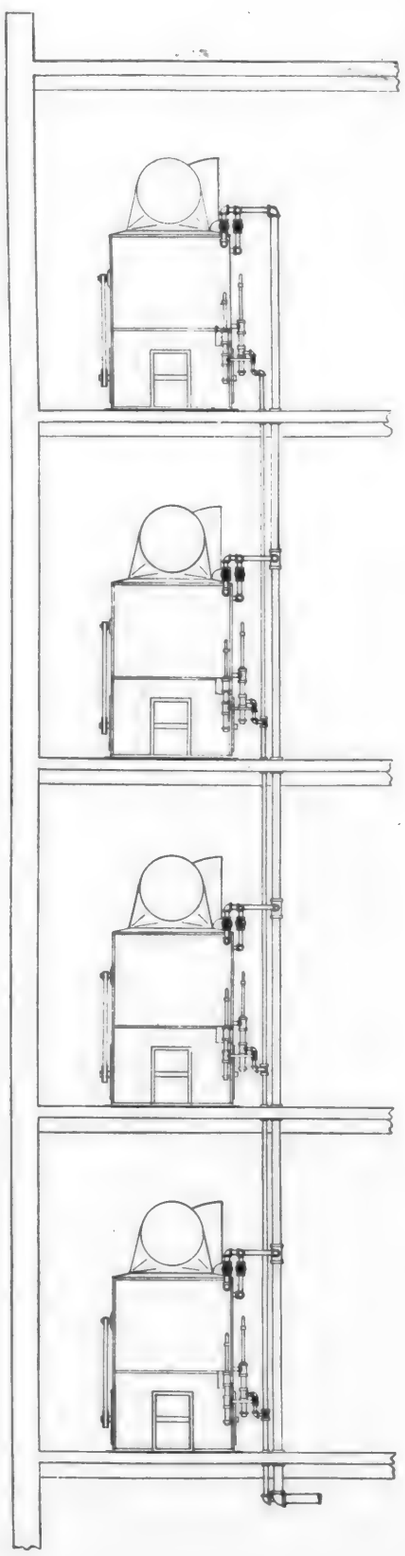
**GRINNELL**
PIPE FITTINGS

***Cast Iron Fittings—Adjustable Pipe Hangers***

# GRINNELL

***Pipe Bends—Welded Headers—Lap Joints—Piping Supplies***

# Skinner Bros. Steam Coil Heaters Applicable to Multi-Story Buildings



## None of the advantages of the Units are lost in buildings of several stories

SKINNER Bros. Steam Coil Heaters may be installed in buildings of several stories with the complete assurance that all of the economies of the heaters are preserved.

The plan at the left indicates how the heaters are installed in the large four story factory building of the Unique Art Mfg. Company, Newark. Tucked away in a corner on each floor a heater carries on its work silently from day to day without attention, casting out over the entire floor a constant supply of fresh warm air. When days are sultry the steam is turned off and the heaters act as huge electric fans circulating the coolest air in the building.

After experience with the old radiator method of heating, Mr. Sam Berger, President of the Unique Art Mfg. Company, writes: "For any future installation we would consider nothing but the Skinner plan." He asserts the installation complete was made at a saving of several thousands of dollars over estimates for direct radiation, and that the factory is heated with a saving of 60% on fuel.

*Free for asking*

SKINNER BROTHERS MANUFACTURING COMPANY INC

Home Office: 1404 S. Vandeventer Ave., St. Louis
Eastern Office: 1710 Flatiron Bldg., New York
Factories at St. Louis and Elizabeth, N. J.
Branches and Sales Offices in Principal Cities

**International Heater Company's** five direct mail campaigns have been chosen to become a part of the direct mail leaders' exhibit of 1927, as announced by Charles R. Wiers, president of the Direct Mail Advertising Association and director of the Graphic Arts Division, D. L. Ward Co., Philadelphia. Participating in the preliminary nationalized contest of direct mail advertising were 125 national advertisers whose groups of campaigns were gathered from all parts of the country. Only fifty groups were selected from this large number of contestants, thus conferring unusual honor upon the firms whose direct mail advertising comprised the five International Heater Company's campaigns, which were produced by the advertising department of the company, at Utica, under the direction of James L. Carr, advertising manager, and Samuel H. Allston, assistant advertising manager.

The fifty campaigns, forming the direct mail leaders' exhibit of 1927, will be shown in Philadelphia for one month, then on the Pacific Coast, in Chicago, Cleveland, and Boston.

The International Heater Company enjoys the further distinction of being the only manufacturer of heating equipment represented in the exhibit.

**Mueller Co.,** Decatur, Ill., suffered a loss of nearly $75,000 worth of damage to its new vitreous ware plant, when a cyclone struck Decatur on May 9.

**Westinghouse Electric & Mfg. Co.,** East Pittsburgh, Pa., reports a record year of sales, the figures coming to $185,500,000. The record figure of last year was exceeded by twenty million dollars.

**National Radiator Co.,** Johnstown, Pa., has completed its new Chicago warehouse which is described as new and modern in every respect. David H. Cuyler is the company's Chicago manager.

**New Chicago Warehouse of National Radiator Company**

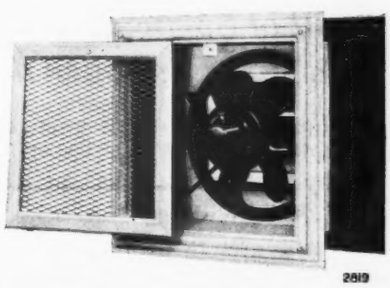
**Lincoln Electric Co.,** Cleveland, O., announces the appointment of Royal D. Malm as western district sales manager, with headquarters in Chicago.

**Jenkins Bros.,** 80 White St., announces the retirement of Arthur C. Langston as an active representative of the company, after an association of 30 years. Mr. Langston will retire to his home in Columbia, Tenn.

**Mueller Co.,** Decatur, Ill., announces a rearrangement of the company's interests, whereby the Mueller Co. of Decatur, Mueller, Ltd., of Sarnia, Ont., and the Mueller Brass Co., of Port Huron, Mich., become separate operating enterprises. In this rearrangement Oscar B. Mueller disposed of his interests in the Decatur and Sarnia holdings of the company to the Decatur company. The Decatur company formerly held a controlling interest in the Port Huron plant, and this interest has been turned over to Oscar B. Mueller. However, Philip and Robert Mueller, of Decatur, will retain their personal interest in the Port Huron plant.

**Handon Boiler Corp.,** New York, has appointed John W. Jones general sales

*For new and old homes! Emerson Exhauster with wall box*




THIS newly designed wall box makes it easy to provide for the permanent installation of a 12-inch Emerson exhaust or ventilating fan in the kitchen or wherever needed.

Adjustable for walls 9½ inches and thicker. Complete with aluminum louver, ready to build into the wall. Puts the fan out of sight, out of the way.

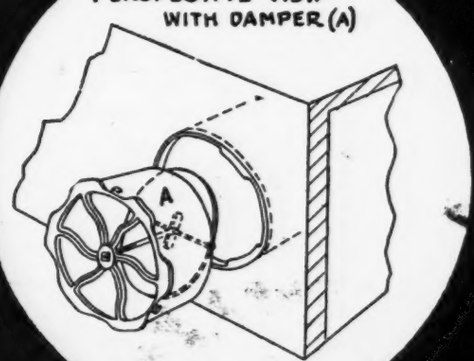
New Emerson bulletins Nos. 3517-3518 give full data and dimensions of fans, 9 to 30 inches in size, and accessories. May we send them?

**THE EMERSON ELECTRIC MFG. CO.**

**2018 Washington Ave., St. Louis, Mo.**

**806 W. Washington Blvd. Chicago, Ill.** **50 Church St. New York City**

PERSPECTIVE VIEW WITH DAMPER (A)




**Disc-Loc**

Reg. U. S. Pat. Off.

The Only ROUND Vent for Gallery Risers!

**EASIER and cheaper to install than the oblong step grills. Also more practical, because its round shape does not weaken the gallery structure. Furnished with or without damper. Prices and blue print sent on request.**

**Knowles Mushroom Ventilator Company**
**202 Franklin St. N. Y. C.**

manager. Mr. Jones was formerly assistant sales manager of Abram Cox Co., of Philadelphia, and more recently New York manager for the Republic Radiator Company. The Handon Boiler Corporation has removed its main office from 101 Park Avenue to 50 Broadway.

**National Air Filter Co.,** 5130 Ravenswood Ave., Chicago, Ill., has taken over in its entirety the air filtration department of Drying Systems, Inc., and will continue to operate it as an individual corporation, but as a division of Drying Systems, Inc. The change was made necessary owing to the growth of the air filtration business during the past year. The personnel and the policy of the company will remain unchanged. Phoenix constant-effect and National rotary air filters are the products now manufactured and distributed, and, in addition to these equipments, special air filters will be designed and installed to meet individual requirements.

**Titusville Iron Works Co.,** Titusville, Pa., announces the appointment of James E. Timmons as Philadelphia representative, with headquarters in the Liberty Trust Building. Mr. Timmons will especially exploit the Titusville boilers for low and high-pressure service.

**Giblin & Co., Inc.,** Utica, N. Y., has increased its capital stock from $125,000 to $500,000.

## Changes of Address

**Wm. B. Scaife & Sons Co.,** Oakmont, Pa., has moved its New York offices from 26 Cortlandt Street to the Architects' Bldg., 101 Park Avenue. H. F. Reynolds is manager of the branch.

**Molby Boiler Company,** Central Foundry Company, Central Radiator Company, Essex Foundry, and the Central Iron and Coal Company, all subsidiaries of the Universal Pipe and Radiator Company, New York, have moved to the Graybar Building, adjoining the Grand Central Terminal, 420 Lexington Ave., New York.

**Reed Air Filter Company,** whose Chicago branch was formerly located at 140 South Dearborn Street, announces its removal to 228 North LaSalle Street.

**Nash Engineering Co.,** South Norwalk, Conn., announces that the New York office of the company at 350 Madison Avenue has been moved to the Graybar Building.

**American Blower Co.,** Detroit, Mich., announces that the Chicago offices which were located at 140 South Dearborn Street, are now at 228 North LaSalle Street in the new Builders' Building. J. H. O'Brien is in charge of the Chicago headquarters.

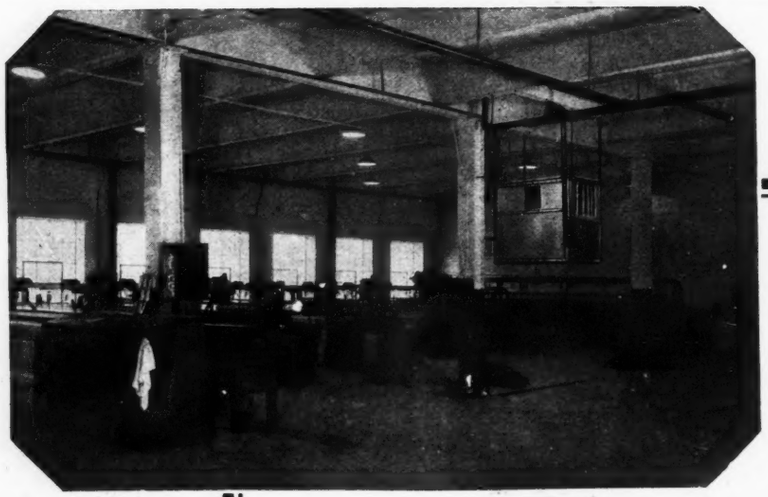
## New Firms

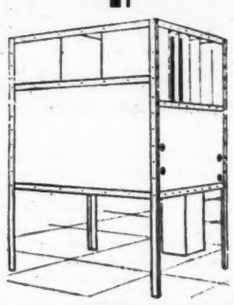
**Hajoca Corp.,** Philadelphia, is the name of a merger of four eastern supply companies of Philadelphia. These are Haines, Jones & Cadbury Company, Keystone Supply & Mfg. Company, Bridgman Company, and Krupp Foundry Company. J. Harvey Borton, president of Haines, Jones & Cadbury Company, was elected president of the new corporation. The capital of the corporation consists of 30,000 shares of $100 par 7% cumulative preferred, and 250,000 shares no par common stock. The combined gross business of the four companies last year was in excess of $16,000,000, and their net earnings last year were $857,853.

**DeSaussure & Buzby, Inc.,** has been organized by Henry W. DeSaussure, a consulting engineer of Jacksonville, and Arthur D. Buzby, a consulting engineer of New York. The new firm will engage in the general practice of engineering. Principal offices will be located in the Florida Theatre Bldg., Jacksonville, Fla.

## Central Heating Notes

**Goshen, Ind.**—A proposed resolution has been submitted to the city council providing for the construction of a central heating distribution system in



*A great share of our business is repeat-order installations—proving that one TWINFAN installation sells another. You, also, can build up a profitable repeat-order business by selling TWINFANS to your customers. Our engineers will gladly help you on your next heating job.*

*a Bit of Spring in Summer—*
*a Bit of Summer in Winter*

Industrial plants and garages equipped with Dwyer TWINFAN Unit Heaters enjoy a nearly constant temperature the year 'round.

In summer TWINFANS may be used as a ventilating system, frequently being connected by ducts to the outside air.

During the winter TWINFANS blast warm air in *two directions* to all parts of the building, each TWINFAN serving twice as large a floor area as a single-fan heater of equal size. It costs far less to heat with TWINFANS than with a direct radiation system—*because TWINFANS keep the heat near the floor where it is needed.*

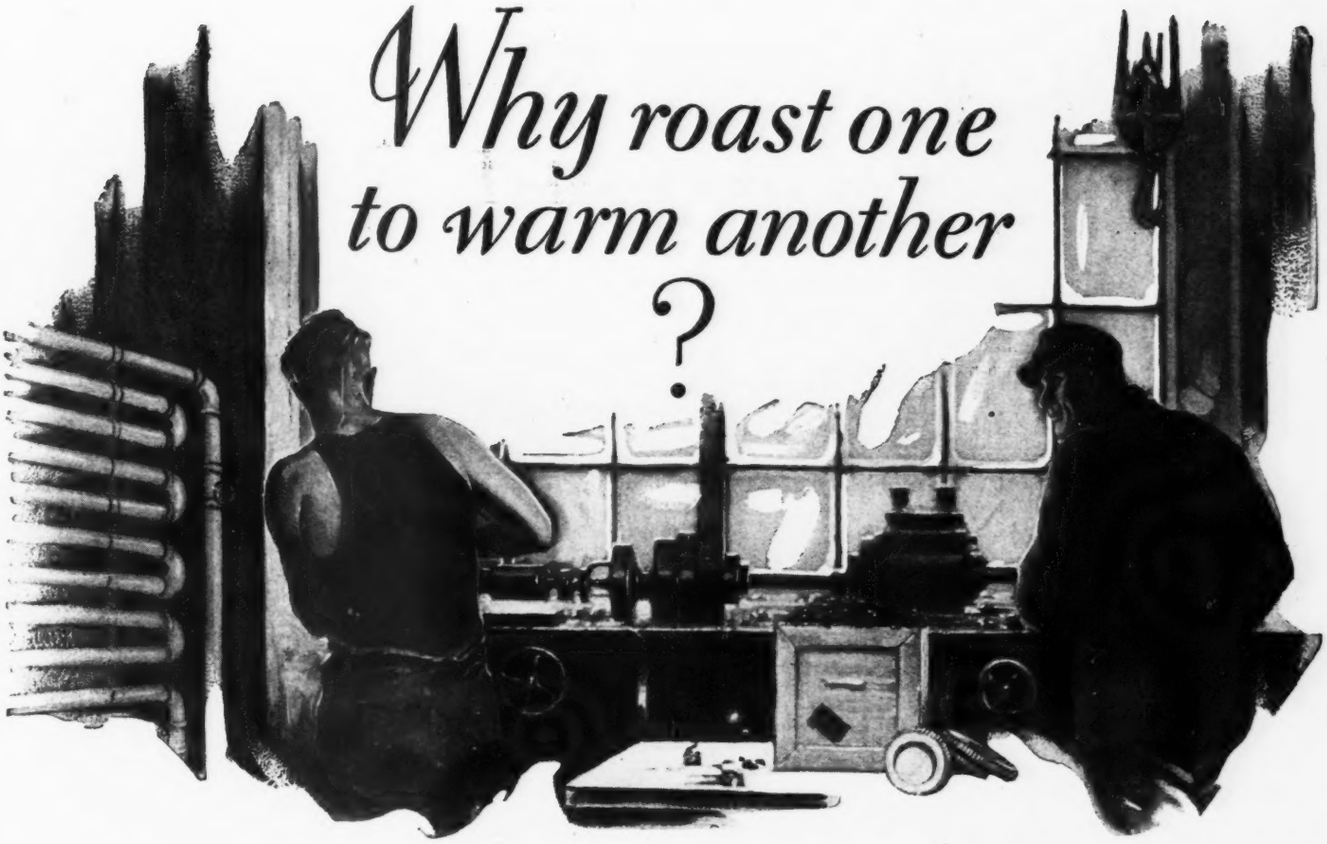
In spring TWINFANS keep the building temperature even—in spite of sudden rises and drops in outside temperature. A turn of the switch and the heat is on or off as required.

***"Heat With Unit Heaters"***

**DWYER EQUIPMENT COMPANY**

**4534 W. North Ave., Chicago, Ill.**

# Why roast one to warm another ?



"Why roast one to warm another?" That's the question users of industrial heating equipment are asking and that is just one of the many strong selling points for the Venturafin Method of Unit Heating.

Venturafin distributes heat evenly all over working areas—not just in one corner, against a wall, or in the ceiling area.

What's more, Venturafin is more than five times as efficient as steam coils, radiators, etc. —gives positive heat control—reduces heat loss to a minimum, and has only one-tenth of the weight of an equivalent amount of ordinary radiation.

These features make the Venturafin method of unit heating the ideal method for you to recommend and the ideal method for your customers to have.

Heating engineers in every locality have welcomed the popularity of the Venturafin method not only from the standpoint of satisfactory user operation, but because of the ease and simplicity of installation.

Write us today for all the facts and don't forget that American Blower sales helps, literature and national advertising are invaluable aids in selling Venturafin.

AMERICAN BLOWER COMPANY, DETROIT
*BRANCH OFFICES IN ALL PRINCIPAL CITIES*
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONT.

Venturafin consists of the following major parts: (1) Copper fin-heater—with five times the radiating efficiency of ordinary iron coils. (2) The famous American Blower Ventura Blower (electrically driven.) (3) Air recirculating box.

(642)

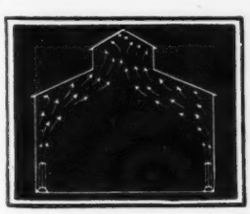
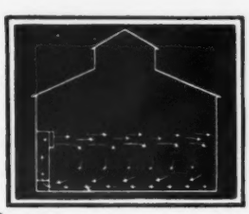


Diagram above shows how heated air rises from radiators, steam coils, etc.



This diagram shows how Venturafin Method distributes heat *evenly* in working areas.

VENTURAFIN TRADE MARK METHOD OF UNIT HEATING

COUPON

AMERICAN BLOWER CO., DETROIT, MICH

Send details relative to The Venturafin Method of Unit Heating to

*Name*_____

*Address*_____

*City and State*_____

*Type and size of building to be heated*_____

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American Blower

"Sirocco" VENTILATING, HEATING, AIR CONDITIONING, DRYING, MECHANICAL DRAFT

MANUFACTURERS OF ALL TYPES OF AIR HANDLING EQUIPMENT SINCE 1881

Goshen, to be supplied with steam from the municipal utility plant. Last Fall the city announced that the municipal steam line, extending south from the city plant to the Goshen Hospital, would be discontinued June 1, because the line was being operated at a loss. Since then all the patrons have petitioned for a continuance of the plant, and have offered to pay a higher rate. A. J. Muth, superintendent of the municipal plant, in reports made to the city council and the board of works, has outlined a plan for the construction of a new distribution system covering the business district from Pike Street to Jefferson Street, and including also Fifth Street. Mr. Muth stated that the distribution system can be built for about $80,000, and only about $30,000 of this need be subscribed. He also suggested that the remainder can be secured through a bond issue.

**Penn Public Service Corp.**, Johnstown, Pa., has just placed a contract with the Northeastern Piping & Construction Corp., North Tonawanda, N. Y., for the installation of considerable underground steam main work in connection with their district heating system.

**POSITION WANTED**—Heating and ventilating engineer desires evening work, around New York City, designing or drafting. Wide experience on all types of systems and buildings. Address Box 62, care of Heating and Ventilating Magazine.

**FOR SALE**—Two Chicago air line pumps, 10,000 square feet capacity, complete with A. C. motors, tanks, regulators, gauges. The Ohio Edison Company, Springfield, Ohio.

# WANTED

**Advertisements under this heading, $2.00 per inch, payable in advance. A 1-in. advertisement contains 35 words. To secure insertion copy must be received not later than the 20th of the month preceding date of issue.**

**HEATING ENGINEER WANTED**—Good opportunity for a capable young heating engineer, one who can design vapor and vacuum heating systems. Location Washington, D. C. State age, qualifications, and salary expected, in first letter. Address Box 61, care of Heating and Ventilating Magazine.

**HEATING ENGINEER WANTED**—Good opportunity in the Rocky Mountain region for a capable young heating engineer, one who can design vapor, gravity, steam and water heating systems, and write specifications. State age, qualifications, and salary expected, in first letter. Address Box 65, care of Heating and Ventilating Magazine.

**HEATING AND VENTILATING SALES ENGINEER**—desires to represent manufacturer. Nineteen years' successful record New York City and vicinity. Designs and services heating installations. Highly regarded by architects, engineers and contractors. Commission basis preferred. Address Box 63, care of Heating and Ventilating Magazine.

**MANUFACTURER'S REPRESENTATIVE**—Manufacturer of complete line of fans, air washers and unit heaters, desires recognized representatives on commission basis. Address Box 64, care of Heating and Ventilating Magazine.


## LOOK HERE YOUNG MAN!

Night School Students and High School Graduates can continue their Technical Training with us from now on. We progress you four times faster than Class Work and thirty times faster than is possible with Shop Training.

That's what we do.

Our instructions are as good as private—It is personal, clear, direct to you. Shop Owners, as well as Mechanics, Foremen, Salesmen, etc., will find this specialized training just like advertising—it pays whether you believe it or not—it works just the same. Write for full information on your choice subject—it's free, write today.

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☐ Special Steam and Hot Water Heating.
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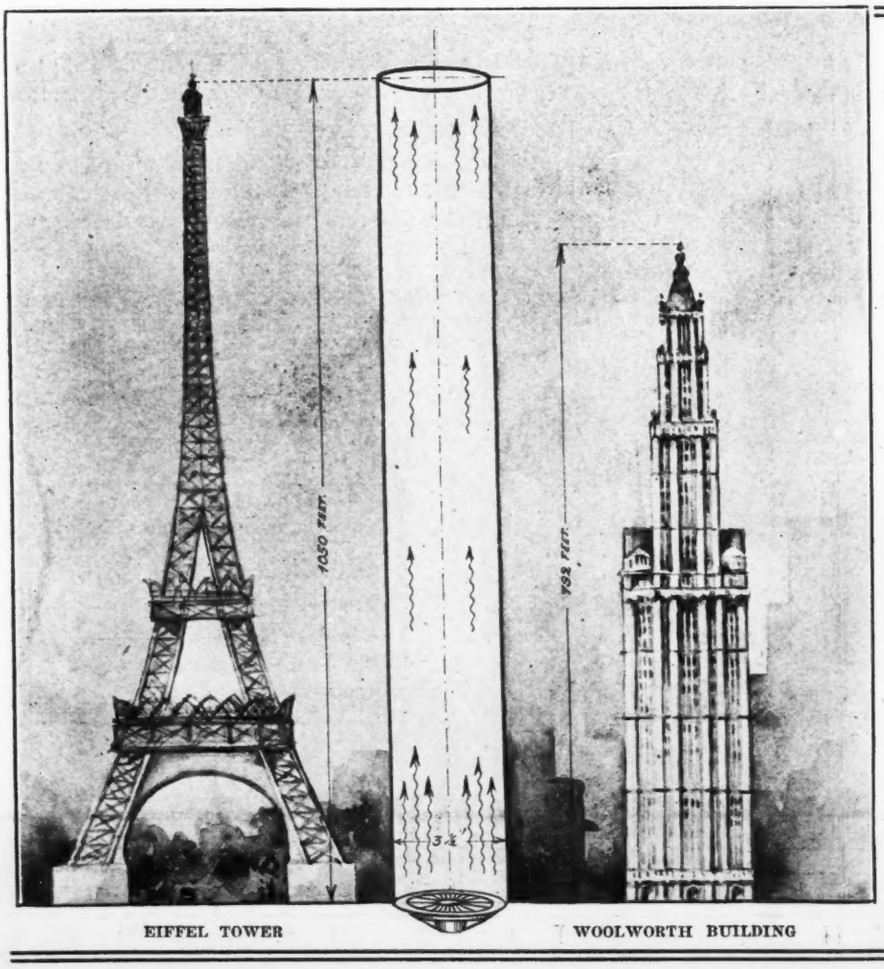


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## A Most Efficient Disc Pressure Fan

The volume of air delivered every minute by a 30 inch **De Bothezat Disc Pressure Fan,** is equal to a column of air 3½ feet in diameter, having a height equal to the height of the Eiffel Tower. The power required for such a peformance being only 2½ H. P.

*This same fan is, in addition, able to give static pressure with a very high efficiency.*

***As the summer months approach, increase the efficiency of your plant with the De Bothezat Fan.***

*Write for Catalog HV*

**De Bothezat Impeller Co.**
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